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THE
LARYNGOSCOPE.

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IMPROVEMENT IN THE SOCIAL ADEQUACY OF HEARING FOLLOWING THE FENESTRATION OPERATION.*†

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T. E. WALSH, M.D., and H. DAVIS, M.D.,§
St. Louis, Mo.

In a previous paper[1] we described the series of preoperative and postoperative tests of hearing administered at the Central Institute for the Deaf to the first 161 patients on whom the fenestration operation was performed by one of us (T. E. W.) at McMillan Hospital (Washington University). In May, 1947, a questionnaire was sent to all of these patients to obtain information as to the patient's own impression of the benefit of the operation. One hundred twenty-three replies to this questionnaire (*i.e.*, nearly 80 per cent) were received, and most of the replies were sufficiently complete to be useful in the present analysis of results. The questionnaire is reproduced in full herewith.

Dear

We are collecting information about the fenestration operation from former patients in order to assess our results thus far. This information is essential to supplement the results of the objective tests which you had at McMillan Hospital and at Central Institute for the Deaf. We, therefore, earnestly solicit your cooperation in completing the enclosed

*This statistical study was carried out under Contract N6onr-272 between the office of Naval Research and Central Institute for the Deaf.

†Read at the Eighty-first Annual Meeting, American Otological Society, Inc., Hot Springs, Va., April 12, 1948.

‡Now at Department of Psychology, University of Virginia, Charlottesville, Va.

§We are indebted to Mrs. Jane MacPherson for most of the tedious counting and calculating involved in this study.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, May 13, 1948.

QUESTIONNAIRE FOR FENESTRATED PATIENTS.

Name..... Date.....

Address..... Tel. No.....

Directly below are listed various degrees of ability to understand speech. Notice the numbers opposite the descriptions:

Understand perfecly (1)
Understand with slight difficulty (2)
Understand with considerable difficulty (3)
Hear but cannot understand (4)
Hear nothing at all (5)

Now, opposite the various conditions listed below indicate under the proper time designation the number from above which best describes your status. If you have had more than one operation the questionnaire applies *only to the first. For example, if you understood perfectly group conversation in a quiet place three months after the operation, write number 1 in the third column opposite the appropriate description.* If you have no occasion to listen under the conditions listed just leave the space blank.

	Before operation	One month after operation	3 months after operation	6 months after operation	9 months after operation	One year after operation
Person to person conversation in a quiet living room or office						
Person to person conversation in a noisy place (streetcar, factory, noisy office, restaurant, etc.)						
Group conversation in a quiet place						
Group conversation in a noisy place (streetcar, factory, noisy office, restaurant, dinner table, social gatherings, etc.)						
Audience (lecture, movies, church, meetings, etc.)						
Telephone conversation						

1. Would you have the operation performed again if you were to experience the same results? Yes..... No..... (check whichever applies).

2. Do your family and friends think the operation was a practical success? Yes..... No.....

3. Did you wear a hearing aid before the operation? Yes..... No.....
Was it Air Conduction (in the ear)?..... Bone Conduction (behind the ear)?.....

4. Do you wear a hearing aid now? Yes..... No..... Is it Air?.....
Bone?.....

5. Do you wear a hearing aid now only under special conditions (such as church, movies, etc.)? Yes..... No..... If so, please indicate which conditions.....
.....

6. Did you have head noises before the operation? Yes..... No.....
If so, please describe them and how often you had them.....
..... Do you have head noises now? Yes..... No.....
If so, please describe them and how often.....
.....

7. Did you ever feel dizzy before the operation? Yes..... No.....
How often?..... Do you ever feel dizzy now? Yes..... No.....
How often?.....

8. During the first two months after operation did you notice any difference in the quality (not loudness) of the speech which you heard? Was it
a) more pleasant.....the same..... less pleasant.....
b) clearer.....the same..... less clear.....

9. What is your occupation?.....

10. Will you please comment on your ability to hear door bells, telephone rings, and music before and after the operation?.....

11. Will you also please add any other comments on the reverse side you believe might be helpful to others contemplating the operation?

.....
.....
.....
.....

questionnaire which we have tried to make as simple and as brief as possible. You have a unique opportunity to help yourself and others who may be contemplating the operation.

Since our statistician is waiting for the information, we would greatly appreciate an early reply. If you encounter any difficulty in completing the questionnaire, please do not hesitate to seek our assistance by mail or telephone.

A stamped addressed envelope is enclosed for your reply.

Please be assured that all information will be treated in the strictest confidence.

We appreciate your cooperation.

Sincerely yours,

Director of Hearing Clinics

We had hoped that the replies to the questionnaire, particularly the scoring of difficulty of hearing in various situations,

would serve, when related to our objective tests of hearing, to establish a *threshold of social adequacy*. The index of social adequacy[2] is the percentage of monosyllabic words (PB lists) that are understood at certain standardized intensity levels. It will be seen that the replies to the questionnaire yield an approximate numerical value of this index that corresponds to a threshold of adequacy. They are even more illuminating, however, in showing the attitude of the patients toward their ability to hear and toward the benefits of the fenestration operation.

THE SOCIAL ADEQUACY INDEX.

The social adequacy index (SAI) was defined[2] as the average articulation score obtained when PB word lists* are played at sound pressure levels of 20, 35 and 50 db above the normal PB threshold. Three intensity levels instead of one were used in order to represent weak speech, average speech and loud speech, *i.e.*, an average of everyday speech. The word lists themselves are so constructed as to sample the various sounds of English speech in proper numerical proportion. The SAI is therefore a word-articulation score based on an average collection of phonetic elements and averaged also for the *intensities at which they* reach the listener.

Determination of SAI.

In practice the PB lists were usually administered at intensities of 70, 80, 90 and 100 db re 0.0002 dyne/cm^2. The SAI was calculated by plotting the corresponding scores and fitting the points with a curve of the shape of a normal articulation curve (see Fig. 1). Experimental points representing scores below 20 per cent were disregarded for reasons explained in our previous paper.[1] The articulation scores corresponding to the sound pressures of 55, 70 and 85 db (for listening under a receiver) or 50, 65 and 80 db (for free-field listening) were read off the graph and averaged.

The SAI for a normal articulation curve with no hearing loss for speech is 98. The lower limit of the normal range of

*Phonetically balanced lists of monosyllables, prepared by the Psycho-Acoustic Laboratory; recorded at Central Institute for the Deaf.

hearing corresponds (tentatively) to SAI = 94. The case chosen for illustration in Fig. 1 is pure conductive deafness and shows no significant impairment of discrimination when the words are loud enough. Other cases show, more or less clearly, a plateau in their articulation curves below 100 per cent, presumably due to a component of high-tone nerve deafness. They cannot understand the most difficult words at *any* intensity, but their curves also shift to the left after operation.

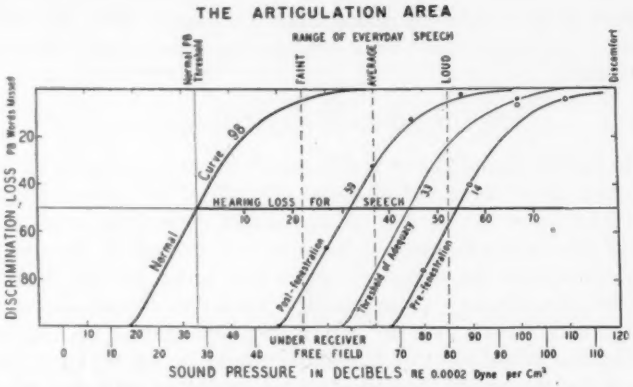

Fig. 1. The double scale of decibels along the horizontal axis makes it possible to use the same graph for monaural listening under a receiver and for binaural free field listening. The scales are adjusted to make our experimental determinations of the No. 9 threshold under the two conditions coincide. The details of this adjustment are discussed elsewhere.[5] A normal PB articulation curve is shown at the left. At the right two curves of the same shape are fitted to two sets of experimental points determined for the same patient before and after fenestration. The social adequacy indices are 14 and 59, respectively. A curve representing the threshold of social adequacy of hearing (SAI = 33) is also shown.

The "normal articulation curve," as determined with the apparatus and the recordings used at Central Institute for the Deaf, is straight with a slope of 4 per cent per db from 5 to 55 per cent. It is concave to the left at its foot to meet the base line 2 db to the left of where they would meet if the line remained straight. If the 50-per-cent-correct point is located at 33 db the upper half of the curve is adequately defined by the following representative points: 36 db, 60 per cent; 40 db, 73 per cent; 46 db, 86 per cent; 56 db, 96 per cent; 70 db, 100 per cent.

Reliability of SAI. We calculated the test-retest correlation of measurements of SAI made on the *unoperated* ears of 156 patients. The coefficient is 0.83, which indicates good reliability. It is a little better than the reliability of the PB threshold (0.78) which is read from the same articulation curve

that is used in the determination of the social adequacy index. The social adequacy index is less reliable, however, than tests No. 9 and No. 12 (see Ref. 1).

Standard Error of Measurement of SAI.

The standard error of measurement of the PB threshold (which defines the position of the patient's articulation curve on the horizontal axis) is about ±5.5 db. The corresponding range in SAI (for hearing losses of about 40 to 45 db) is about 11 points; therefore as many as one-third of our SAI values may deviate by more than 11 points from the true means that would have been obtained by a very large number of tests.

THE THRESHOLD OF SOCIAL ADEQUACY.

In their original paper Walsh and Silverman[2] introduced the concept of a "threshold of social adequacy," *i.e.*, the value of the SAI below which the patient would experience a serious social handicap from his deafness in half or more of his everyday situations. No numerical value was given for the threshold but for illustrative purposes a tentative threshold curve was drawn with a loss for speech of 35 db and an SAI of 46. A definite value for this threshold would be useful in evaluating the success of the fenestration operation. An operation could be considered a practical success if the patient's Social Adequacy Index were raised across the threshold of social adequacy even though the improvement in decibels of hearing loss might be relatively small. We undertook to estimate such a threshold, but we have adopted a more severe criterion, *i.e.*, *the level at which an ear* (without a hearing aid) *ceases to be of much social value.*

Limiting value of SA threshold. The preoperative SAIs for the ears that were operated upon were calculated and tabulated. The result is shown graphically in Fig. 2. Only one ear showed an index above 37. It seems reasonable to accept this as a practical indication of a threshold of adequacy. Only one patient actually had the operation performed on an ear better than this. Ears worse than this the surgeon (T. E. W.) considered poor enough to be risked in an uncertain operation.

If we examine the binaural SAIs of the group (dotted histogram in Fig. 2), we see that the clearest cutoff is at SAI = 48. Only 10 per cent of the patients had higher indices. There is a secondary cutoff at about 67, with only four scattering cases above it.

We interpret these data as follows: A very few patients who had one nearly normal ear wanted improved hearing in their worse ear enough to undergo the operation; but social difficulty really begins only when the index has fallen to 67, *i.e.*, when only two-thirds of the PB words are correctly under-

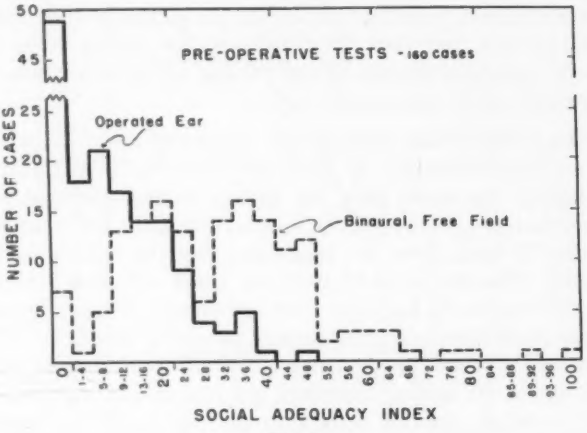

Fig. 2.

stood on the average. Several patients with indices between 67 and 50 elected to have the operation performed. When the index falls below 50 many patients want the operation, — but the surgeon refused to operate on ears that had indices higher than 37. He invariably operated on the patient's worse ear, which he considered practicaly useless.

The clearest cutoff, at about SAI = 50, corresponds, for an ear with perfect discrimination, to a hearing loss of 35 db. This "threshold," however, is where difficulty *begins* rather than where an ear *ceases to be adequate* or where a person

"just gets by" with real difficulty. We must look elsewhere for the latter thresholds.

THRESHOLD OF SOCIAL ADEQUACY DERIVED FROM QUESTIONNAIRE RATINGS.

Study of the patient's self-ratings on the questionnaire in relation to their objective performances on word and sentence tests aided us in selecting tentative threshold values. It also showed the great importance of psychological factors in evaluating the benefits of the fenestration operation.

One hundred twenty-three out of 161 patients filled out the questionnaire, but only 71 filled out the rating scale completely. (Some could not fill out the last columns because their operations were too recent.)

In order to find whether the results of these 71 cases* were representative, a "t" test* was run to determine whether the mean gain for speech in the operated ear (measured by Test No. 9) was significantly different for these 71 cases from the mean gain for the remaining 90 cases. The test showed that the small actual difference in the means is no more than we should reasonably expect from chance fluctuations in sampling the data. The probability that it represents a real difference is less than 19 out of 20, and is therefore not considered significant. We conclude that in respect to the results of the operation the 71 cases are adequately representative of the entire group.

As an overall measure of the patients' rating of their own hearing, we first took the average of the individual ratings, 1 to 5, for the six situations listed in the questionnaire. A patient who felt that he understood speech perfectly in all situations would therefore score 6/6 or 1.0, while one who heard nothing at all would score 30/6 or 5.0. The six situa-

*For several analyses more than 71 questionnaires were adequately filled out. We have used all of the available information in every case. N will therefore vary from one analysis to another. We assume that the "t" test here described justifies the assumption that the various samples so obtained are all representative of the entire group.

tions, *i.e.*, person to person in quiet, person to person in noise, group conversation in quiet, group conversation in noise, audience listening in movies or meetings, and telephone conversation, are fairly representative, although some patients wished to distinguish between movies and other audience situations.

When we prepared the questionnaire we intended to define the rating scale so that the threshold of adequacy, as we conceived it, would lie at 3.5, half-way between "understand with considerable difficulty' (3.0) and "hear but do not under-

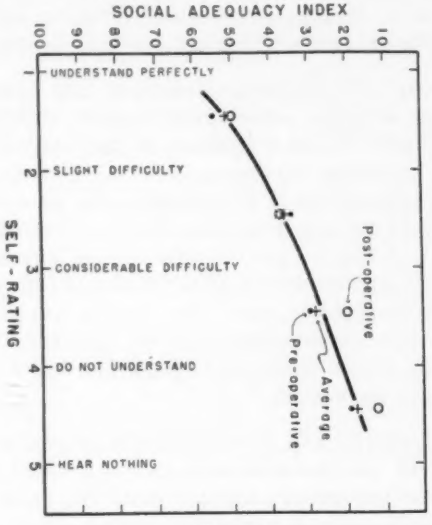

Fig. 3.

stand" (4.0). But a cursory examination of the replies in relation to hearing loss revealed an almost unbelievable degree of optimism. Patients who had between 50 and 60 db loss for speech (Tests No. 9 and No. 12, binaural, in free field) rated themselves at about 2.7 on our scale. They claimed to understand with more than "slight" but less than "considerable" difficulty! (See Fig. 3 and Table III.) From our normal-hearing point of view this proposition is absurd, but it is an

important warning that the same words mean different things to different people.

For closer analysis we selected three of the six listening situations that correspond quite well to the three speech levels (faint, conversational and loud) on which the concept of the social adequacy index is based. These situations are *1.* audience listening, *2.* person-to-person in quiet, and *3.* person-to-person in noise. (Additional difficulties in understanding that are introduced by group situations are eliminated, and so is the relatively easy telephone listening. The latter should be eliminated, as it represents *monaural* listening and we wish to compare the ratings with tests of binaural hearing.)

The group and telephone situations that were eliminated were actually rated about equally difficult with those retained. To get a measure of the relative difficulties of the situations we averaged for each situation separately the self-ratings of all subjects who showed a preoperative loss for speech between 35 and 60 db (binaural free field). A similar postoperative set of averages was made for all subjects with a 35 to 60 db loss for speech on the first postoperative test. The results are shown in Table I. Audience listening is, as we expected, the most difficult, and person-to-person in noise and telephone conversation are the easiest.

The preoperative and postoperative averages in Table I should not be compared directly as the average hearing losses of the two groups are not quite the same. Some individuals are common to the two groups, others are not.

The relative ratings of the different situations by the patients agreed well with our expectations, and give us confidence in other aspects of the self-ratings. Our expectations were based on our clinical experience with patients suffering from conductive and mixed deafness.

For further analysis the average rating on the three selected situations (audience, and person-to-person in quiet and in noise) was calculated for all available subjects before and also

shortly (three to six months) after the operation. Of course, these reports were all made in May, 1947, at varying intervals after operation. Some patients may have magnified, others minimized, their preoperative difficulties. Some, particularly those who subsequently suffered closure of the fenestra and regression of hearing, may have idealized the state of their hearing in those happy bygone months when it was temporarily improved.*

TABLE I.
AVERAGE SELF-RATINGS IN VARIOUS LISTENING SITUATIONS.

	Preoperative (N = 82)		Postoperative (N = 54 to 56)	
Person-to-person in noise	2.05		1.61	
Telephone		2.17		1.57
Group in noise		2.44		1.97
Person-to-person in quiet	2.86		1.97	
Group in quiet		3.37		2.39
Audience	3.50		2.58	
Average	2.76	2.67	2.05	2.04
Grand average	271		2.05	
Average hearing loss for speech	49.1 db		45.0 db	

See questionnaire for explanation of self-rating scale. The averages in this table are based on patients with hearing losses for speech between 35 and 60 db (binaural free field), i.e., those in the "threshold zone" of hearing.

The table shows that the subjects do discriminate as expected among the different situations. For example, the preoperative group "understand with slight difficulty" (2.05) in person-to-person conversation in a noisy place. They are about midway between "understanding with considerable difficulty" and "hearing but not understanding" in audience listening (3.50). In making this table we excluded patients with losses less than 35 or more than 60 db because their ratings (many "perfects" or "do not hear at all") would have partly obscured the differences in difficulty represented by the different situations.

In Tables II, III and IV and in Figs. 3, 4, 5 and 6 the data are presented from two different points of view. In each case the preoperative and postoperative values are calculated separately and then combined. The difference is that in Table II and Figs. 3 and 4 the subjects are divided into five categories according to their average self-rating (those from 1.0 to 1.9, those from 2.0 to 2.9, etc.) and then the average SAI or the average loss for speech is calculated for each category. In

*We are now asking subjects to rate their hearing **each time they return for retest** in order to avoid such a "halo effect" in our future studies.

Tables III and IV and Figs. 5 and 6, on the other hand, the subjects are first divided into categories according to the results of the hearing tests (SAI or loss for speech) and then the average self-rating is calculated for each category.

TABLE II.
RELATION OF SAI AND OF LOSS FOR SPEECH TO SELF-RATING ON QUESTIONNAIRE.

Self-rating*	1.0 to 1.9	2.0 to 2.9	3.0 to 3.9	4.0 to 4.9	5.0
Social Adequacy Index					
Preoperative	§(8) 54.0	(36) 34.5	(42) 30.0	(7) 19.3	(5) 1.4
Postoperative‡	(39) 50.0	(46) 37.5	(10) 20.3	(2) 13.0	(1) 0.0
Average	(47) 51.2	(82) 36.5	(52) 28.2	(9) 17.9	(6) 1.2
Loss for Speech† in db					
Preoperative	(8) 38.1	(36) 48.1	(42) 51.7	(7) 57.4	(3) 70.5
Postoperative‡	(36) 35.7	(41) 44.1	(8) 54.5	(2) 66.3	(1) 73.5
Average	(44) 36.1	(77) 46.0	(50) 52.2	(9) 59.4	(4) 71.3

*Ratings are on (1) Person-to-person in quiet (2) person-to-person in noise, and (3) audience listening.

†Most of these are averages of No. 9 and No. 12 measurements. For 12 cases only one measure or the other was available.

‡This is the first postoperative test in nearly all cases and the rating is for three months after operation.

§Numbers in parentheses show the number of cases in each category.

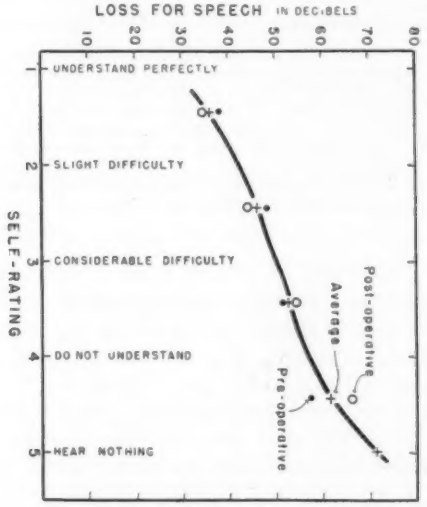

Fig. 4.

TABLE III.

RELATION OF SELF-RATING ON QUESTIONNAIRE TO SOCIAL ADEQUACY INDEX.

Social Adequacy Index	>69	69-60	59-50	49-40	39-30	29-20	19-10	<10
Preoperative rating.....	(2) 1.5	(6) 2.7	(3) 2.3	(20) 2.8	(21) 2.8	(18) 3.0	(18) 2.9	(10) 4.3
Postoperative rating	(6) 1.3	(11) 1.5	(18) 2.0	(12) 1.7	(19) 2.0	(13) 2.5	(14) 2.4	(5) 3.6
Average	(8) 1.3	(17) 2.0	(21) 2.1	(32) 2.4	(40) 2.4	(31) 2.8	(32) 2.7	(15) 4.1

TABLE IV.

RELATION OF SELF-RATING ON QUESTIONNAIRE TO LOSS FOR SPEECH.

Loss for Speech in db	22.5	27.5	32.5	37.5	42.5	47.5	52.5	57.5	62.5	67.5	72.5	77.5	80.0
Preoperative rating.....	(0)	(1) 1.3	(0)	(5) 2.7	(10) 2.9	(25) 2.7+	(29) 2.8	(11) 2.9	(8) 3.7	(3) 3.9	(2) 4.2	(1) 5.0	(0)
Postoperative rating....	(2) 1.7	(7) 1.8	(11) 1.8	(16) 1.6	(18) 1.9	(9) 2.3	(9) 2.6	(7) 2.4	(4) 2.3	(2) 3.0	(1) 5.0	(0)	(1) 4.7
Average.....	(2) 1.7	(8) 1.5	(11) 1.8	(21) 1.9	(28) 2.3	(34) 2.6	(38) 2.75	(18) 2.6	(12) 3.25	(5) 3.6	(3) 4.4	(1) 5.0	(1) 4.7

Of course, if there were a perfect correlation between the objective tests and the self-ratings the results of these two methods of approach would be the same; but the correlations are far from perfect (see Table VI, based on self-ratings for all six listening conditions). It is perfectly reasonable, therefore, to find in Figs. 5 and 6 a very clear difference between the preoperative and postoperative ratings as a function of actual objective hearing loss, while in Figs. 3 and 4 the preoperative and the postoperative points intermingle so closely that we have not even drawn separate lines for the two.

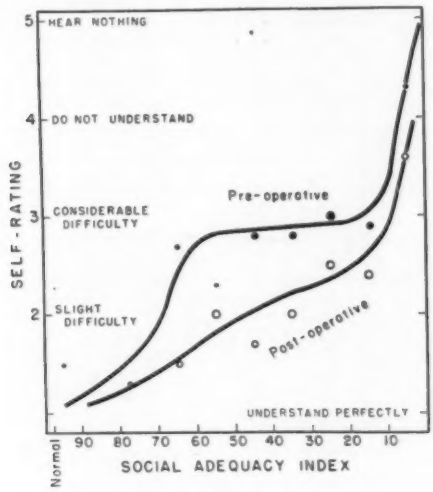

Fig. 5.

"Our original problem in this analysis was to find a "threshold" value for the social adequacy index. If we are willing to accept an average self-rating of 3 ("understand with considerable difficulty") as the correct definition of threshold the problem is solved in Fig. 3. The ordinate "3" crosses the average curve at SAI = 31. By the same method in Fig. 4 we find that the "threshold" loss for speech is 50 db."

Actually these two values, SAI = 31 and Loss for Speech = 50 db, are not compatible. An articulation curve drawn on Fig. 1. with a hearing loss for speech of 50 db could not have an SAI of more than 20, even if the ear had no discrimination loss. It must be remembered, however, that the SAI in these tests was derived entirely from PB tests and the loss for speech was measured with Tests No. 9 and No. 12. The discrepancy of 11 points on the SAI scale (or about 5 db on the hearing loss scale) is not very serious.

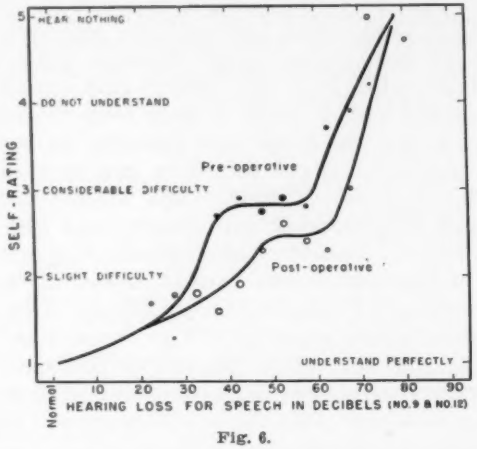

Fig. 6.

Before accepting these values as the "threshold of social adequacy" let us examine more closely Figs. 5 and 6; and, in order to minimize the "halo effect" and any imaginary or wishful "improvement" following the operation, let us look only at the preoperative curves. Apparently all groups with losses for speech of more than 30 db (or SAI less than 70) believed that they had "difficulty" and the difficulty approached "considerable difficulty." This is quite reasonable. Why would anyone have the operation performed if he is not having "considerable difficulty" in ordinary situations? Certainly in retrospect he will tend to justify having had the operation by rating his hearing about this way. (The exceptions, with the very small losses, are the unilateral cases previously mentioned. The tests here in question are binaural tests.) *The remarkable feature of the curves is the long pla-*

teau from 35 to 60 db loss for speech and from SAI 65 to 15. Over this whole range the subjects do not admit of more than "considerable difficulty" on the average.

The "Threshold Zone": A Psychological Interpretation.

"We venture an interpretation of this threshold zone of 25 db. We believe that one factor is a gradual accommodation of individuals who suffer from progressive deafness. By degrees they forget to some extent how well they once heard. Their standards of comparison change. Second, many of them, whether they realize it or not, learn to gain some assistance from lipreading and by filling in gaps from the context. A third point is that our terms were probably not well chosen. There is probably a larger subjective gap between "understand with considerable difficulty" and "do not understand" than between understanding with "slight" and with "considerable" difficulty. Probably many subjects interpreted "considerable" difficulty to include "great" as well as "moderate" difficulty, making it a wide subjective category. This situation would tend to flatten the curves of Figs. 5 and 6 as they pass through the "difficult" range. [In our current questionnaire (1948) rating 3 is defined as "understand with *great* difficulty."]

"Probably more important than all these three factors together is the *assistance given by speakers in talking more loudly for the benefit of the hard of hearing.* Particularly in the person-to-person situation in the quiet will the talker "speak up," as much as is necessary in order to be understood, to the limit of his vocal cords. Even in group conversations allowance will usually be made for the presence of a hard-of-hearing member who asks for repetitions. (In the audience situation the lecturer or minister does not speak louder, but the hard-of-hearing listener learns to seek a front seat, which gives an equivalent gain in loudness.) Communication is possible with "considerable difficulty." The point is that the difficulty is shared by the talker. Finally, however, when hearing loss for speech becomes greater than 60 db, other people will not or cannot compensate further by shouting louder or getting closer, and the hard-of-hearing listener

passes rather abruptly out of the twilight threshold zone into the dark area of "cannot understand."

Numerical Values of Thresholds of Adequacy.

Our search for a "threshold of social adequacy of hearing" has therefore yielded not one threshold but two, with a wide zone between. From the information set forth, particularly in Figs. 3, 4, 5 and 6, we have adopted the definitions and numerical vales shown in Table V for the several thresholds. The values are all arbitrary composites, rounded off for convenience, and subject to revision as additional information becomes available; but we find them useful guides in our own thinking.

TABLE V.

THRESHOLDS OF HEARING.

Threshold	Db Loss for Speech*	SAI†
1. Normal	0	98
2. Limit of normal	9‡	94
3. Social difficulty begins	30	67
4. Threshold of social adequacy (middle of threshold zone)	45	33
5. Limit of compensation	60	10-15
6. Limit of compensation with a hearing aid	Still to be determined	

*These values apply only to ears with perfect discrimination, i.e., ears that can hear correctly all PB words if they are made loud enough.

†The Social Adequacy Index takes into account loss of discrimination as well as loss of sensitivity.

‡This limit is three times the standard deviation for a group of normal listeners (see Refs. 4 and 5).

We shall use the value of SAI = 33 in judging the success of the fenestration operation in "restoring patients to social adequacy." At SAI = 33 a listener with a reasonably "flat" audiogram understands correctly one-third of the PB words delivered at the three speech levels. He understands few if any words at the "faint" level but he understands well at the "loud" level.

The values in the first column agree well with our clinical experience in regard to hearing aids, at least for patients who do not have too much nerve deafness. With a 30 db loss a hearing aid should be considered, with a 45 db loss an aid should certainly be worn, and with a 60 db loss a patient is completely dependent on his aid.

FURTHER CORRELATIONS OF SPEECH TESTS WITH QUESTIONNAIRE RATINGS.

"There is a wide spread among the self-ratings associated with any given loss for speech, and vice versa. We have offered several explanations for this spread. With such a spread we cannot expect a high correlation between the objective measures of hearing and the self-ratings." The correlations were calculated, nevertheless, between the self-ratings (averaged for all six listening conditions) and five different measures or combinations of measures of hearing. The results (see Table VI) show that the SAI is the best (although not a very good) single predictor of the patients' ratings, but No. 9 is almost as good.

TABLE VI.

CORRELATION BETWEEN TESTS OF HEARING AND PATIENTS' SELF-RATING (PREOPERATIVE).

Test	N	r	R
No. 9 (Binaural in free field)	100	+.47	
SAI (Binaural in free field)	102	—.50	
Bone conduction (hearing loss of ear to be operated)	59	+.30	
No. 9 and Bone Conduction			.48
SAI and Bone Conduction			.52

The third column, r, gives the Pearson Product Moment Correlation. If those who rated themselves lowest (hearing best) also showed the lowest hearing losses (by No. 9 or bone conduction), and those rating highest (worse hearing) showed the greatest losses, and there were similar consistency in between, the coefficient would be +1.0. For SAI (good hearing expressed by a high score) a perfect correlation would give a coefficient of —1.0. If there is no correspondence the coefficient tends toward 0.

The third column, R, gives the multiple correlation coefficient. The calculation of these coefficients is described in most standard reference books on statistics.

The ratings for person-to-person conversation in a noisy place were correlated separately with binaural SAI (preoperative values for 105 cases). The coefficient r is only –.32.

The combination of audiometric loss by bone conduction with SAI was tried in the hope that the combination might better predict the ability to hear in noise, but the prediction (R = .52) was not noticeably better than for SAI alone (r = –.50).

IMPROVEMENT IN SOCIAL ADEQUACY INDEX FOLLOWING FENESTRATION.

We have calculated the average improvement in the SAI following fenestration, both for the operated ear alone (mon-

aural measurements) and for the patient as a whole, tested binaurally in the free field. The latter criterion is the one of interest to the patient. The surgeon also has a legitimate technical interest in the monaural tests, since he usually operates on the worse ear. A failure, *i.e.*, loss of all remaining function, may not show at all in the binaural test, and neither will partial successes in which the operated ear is improved but does not quite become equal to the better ear.

Our present calculations are based on the first postoperative tests (not over eight months after operation) and also, where available, on the tests nearest to one year after operation. The means are calculated separately for 92 cases who gave adequate answers to the questionnaire, and for all patients on whom technically satisfactory tests were obtained at the proper time intervals. The results are tabulated in Table VII. (Pertinent information is also to be found in Fig 5, in which the postoperative self-ratings are compared with the preoperative.)

TABLE VII.
SAI GAINS FROM FENESTRATION.

	First Test—Up to 8 Months			Second Test—9-15 Months		
	N	Mean	σ	N	Mean	σ
Binaural, free field.						
Answering questionnaire	92	9.59	14.23	43	5.30	13.54
All cases	156	8.57	14.96	69	4.39	15.60
Operated ear, receiver.						
Answering questionnaire	92	16.87	21.33	45	15.18	17.22
All cases	156	15.61	20.28	70	14.31	18.01

The gains in SAI are small and the standard deviations are large, and few conclusions can be drawn from the data. These unsatisfactory results are due primarily to the use of the cartilage stopple in a majority of the cases in the present series. The stopple has been adequately discussed in our previous paper.[1] We will comment briefly on only a few features of the statistical analysis for what they may be worth, and all of the findings should be regarded as tentative. They will serve as guides, however, in the analyses of future series in which, without the cartilage stopple, much greater gains will be obtained.

In Table VII the mean gain in SAI is less on the binaural test after 9 to 15 months than on the early postoperative tests. This might be due to early closure of some of the fenestra, but the difference does not appear on the monaural tests and we believe it is due merely to a sampling error. The whole question of closure and of revision will be discussed elsewhere, and the following analyses will be confined entirely to measurements made within the first eight months after operation.

Our best present indication of the amount of gain in the Social Adequacy Index and the percentage of patients who were brought across the threshold of adequacy (SAI = 33) is

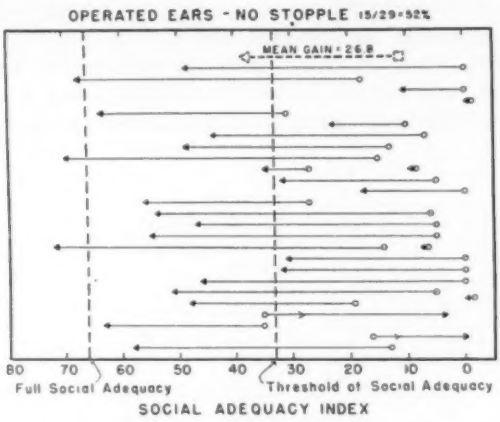

Fig. 7.

found in the cases in which the stopple was not used. These results are shown graphically in Figs. 7 and 8. The mean gain in SAI is 26.8 by monaural test on the operated ear and 15.0 by binaural free field test.

The mean gain in self-rating for 85 cases answering the questionnaire adequately, based on the audience and person-to-person situations, was 0.84, less than the difference between "slight" and "considerable" difficulty. It is evident, however, from Figs. 5 and 6 that a large part of this subjective gain is

a "psychological" improvement that does not correspond to any real improvement on the objective hearing tests.

The correlation between actual gain in SAI and the patients' gain in self-rating is only $r = -.53$ ($N = 98$). The corresponding correlation between decibels gain for speech and gain in self-rating is $r = -.51$ ($N = 88$). These rather low correlation coefficients attest the importance of psychological factors in addition to the actual objective improvements. The coefficients are reduced by the patients who made little or no actual gain but who nevertheless rated their postoperative hearing better than their preoperative hearing.

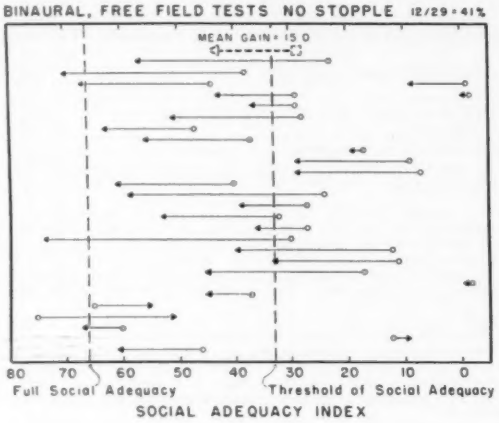

Fig. 8.

Prediction of SAI gains in operated ear. If there were any clear relation between the SAI gain (monaural) in the operated ear and any one or combination of preoperative tests of hearing, the latter could be used to advantage in selecting cases favorable for operation or in improving the prognosis for the cases chosen. It will be seen, however, in Tables VIII and IX that all of the correlation coefficients are very small. Only the relationship to clinical grouping is significant at the 5 per cent level, *i.e.*, 19 chances out of 20 that the coefficient

represents a real difference and not the operation of the laws of chance.

Relation of SAI gain to satisfaction. By "satisfaction" we mean that the patient answered affirmatively the question, "Would you have the operation performed again if you were to experience the same results?"

The SAI final score and the gain in SAI were plotted for the two answers to this question; both for scores up to eight months and for scores between nine and 15 months after the operation.

TABLE VIII.
CORRELATIONS OF SAI GAIN (monaural, measured within eight months) WITH PREOPERATIVE HEARING TESTS.

Test	N	r‡
Bone conduction threshold (ave. 512, 1,024, 2,048, 2,896)	48	—.20
No. 9 threshold	76	+.06
PB threshold (50 per cent correct)	133	+.16
PB score at 100 db	133	+.11
Maximum PB articulation score*	76	+.01
Difference in rating for hearing† in noise and in quiet (from questionnaire)	52	+.14

*To obtain a better measure of the maximum articulation score than is given by arbitrarily taking the score at 100 db intensity, scores and cases were selected as follows to obtain the 76 cases of maximum PB score:

a) The scores accepted were either
   1) 95 per cent or better; i.e., not significantly below 100 per cent, or
   2) obtained at an intensity not less than 28 db above the No. 9 threshold.

b) Two cases were rejected in which the operation caused a loss of hearing of more than three times the standard error of measurement. These cases were obviously surgical mishaps at the time of operation and the failure was not connected with the preoperative condition.

†Based on the difference in self-ratings for situations 1 and 2 on the questionnaire, i.e., person-to-person conversation in a quiet and in a noisy place, respectively.

‡The third column (r) is the Pearson Product Moment Correlation coefficient. The "t" test shows that none of the values is significant at the 5 per cent level of confidence.

Satisfaction is related to final score, to intermediate score and to the gain in SAI (see Table X).

These relationships have important implications for the overall evaluation of the operation. Our patients considered the operation worthwhile if they have achieved a certain amount of gain, even though few of them reached very high final levels, and even though all of the gain was not permanent. "Biserial eta" was calculated for:

1. Relation of SAI *score* (nine to 15 months post-operative) to "Yes-No": .....eta = .10

2. Relation to final *gain* to "Yes-No": .....eta = .42

It is clear that the relation to *gain* is much stronger than to the *final* Social Adequacy Index. This substantiates our earlier interpretation that the patients' self-ratings were largely determined by their standards of comparison. "Considerable difficulty" was apparently a very vague term, but "a little

TABLE IX.
MEAN SAI GAINS FROM FENESTRATION FOR THE THREE CLINICAL GROUPS.

	N	SAI Gain	α	Tri-serial Eta*
Conductive	83	18.85	20.77)	
Conductive-mixed	41	15.76	22.80)	.23
Mixed-nerve	33	6.73	10.86)	

*The "Tri-serial Eta" is a measure of the correlation. In this case it is significant at the 5 per cent level of confidence. This correlation would undoubtedly be higher if some cases of pure nerve deafness had been included, as their gains would have been negligible. The tests of significance for this coefficient and for the "r" values in Table VIII are not entirely satisfactory as the distribution of the SAI gains is probably not normal.

TABLE X.
PATIENTS' SATISFACTION IN RELATION TO GAIN IN BINAURAL SAI AND TO THE FINAL SAI ATTAINED.

Final SAI / Gains in SAI	Final SAI Over 30	Maximum (but not final) SAI Over 30	Final and Maximum SAI Less Than 30
Final gain more than 10....	yes* 15	yes 0	yes 3
	no 1	no 0	no 0
Maximum (but not final)	yes 6	yes 1	yes 2
gain over 10	no 2	no 1	no 0
Final and maximum gain	yes 10	yes 0	yes 0
less than 10	no 6	no 0	no 5

*Meaning: "I would have the operation performed again if I were to experience the same result."

improvement is easily recognized. Apparently, when a patient is in the "threshold zone" near the limit of adequacy, he can appreciate a gain of as little as 10 points in his index. This and the "psychological lift" from the operation may explain why so many results that were disappointing to the surgeon were regarded as beneficial (though not ideal) by the patients themselves.

SUMMARY.

A questionnaire was submitted to 161 patients on whom the fenestration operation had been performed prior to October, 1946, and whose hearing had been studied by audiometry and by speech tests (most of them phonographically recorded) before and a few months after operation. In the questionnaire the patients indicated their degree of difficulty in hearing in a variety of social situations. From the hearing tests we calculated each patient's hearing loss for speech, in decibels, and also his social adequacy index. This index is the average percentage of monosyllabic words (arranged in phonetically balanced lists) that are correctly understood under standard conditions of faint, conversational and loud speech.

Comparisons of patients' self-ratings before and after the fenestration operation showed that for equal objective hearing losses the patients believed their hearing to be *better* after the operation than before. Part of this "psychological" improvement probably depends on the contrast between a patient's partly restored hearing after operation and his more severe hearing loss before operation.

A "threshold zone" of hearing extends from a hearing loss for speech of about 30 db (social adequacy index 67), at which patients begin to have significant social difficulty, to a loss for speech of about 60 db (social adequacy index 10 or less). At the latter level, called the "limit of compensation," talkers cannot or will not speak loudly enough to enable the hard of hearing to understand. The middle of the threshold zone, about 45 db of loss for speech (social adequacy index 33), is taken as the "threshold of social adequacy of hearing." Throughout the threshold zone our patients reported that before operation they understood with something between "slight" and "considerable" difficulty on the average.

If a patient's hearing was within the threshold zone both before and after the operation he usually believed the operation to have been beneficial if he gained even as little as 5 db hearing for speech (or 10 points on the social adequacy index).

Practical success of the fenestration operation from the patient's point of view we define as improvement of his hearing (measured binaurally, by speech tests) from below to a level above the threshold of social adequacy. By this criterion, in the present series 41 per cent of the 29 cases on whom the operation was performed without the cartilage stopple were at least temporarily successful.

Statistical calculations are presented of several other relationships between preoperative tests of hearing, actual improvement of hearing, and the subjective improvement reported in the questionnaires. No other very significant relationships were found, however, due in part at least to *1.* the small actual gains made in cases in which the stopple was used, and *2.* the psychological factors that influence self-rating both before and after operation.

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CARCINOMA OF THE LARYNX.*†

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In 1940, a report on all cases of carcinoma of the larynx treated surgically up to that time, and on the end-results based on a five-year study of 113 cases was made before this Society.[1] Today, eight years later, a report will be made on the entire group, including cases treated during the intervening years. In this, it will be observed that there has been a tendency towards more radical surgery as a primary operation, towards surgical treatment rather than irradiation in cases of metastasis to regional lymph nodes, and surgical treatment without or with irradiation in advanced primary cases with metastasis.

This report will cover a series of 369 cases of cancer of the larynx operated upon five years or more previously, and an additional 264 cases operated upon within the past five years. In 286 cases the primary operation was thyrotomy, while laryngectomy was performed in 343. Four cases were treated by endolaryngeal measures.

Sex and Age: While these are of little significance in a study of individual cases, they are of statistical importance. Of the entire group of 633 cases treated surgically, there were 39 women (6.3 per cent); 21 of these were treated by thyrotomy and 18 by laryngectomy. Strangely, 10 of the cases of thyrotomy were 40 years of age, while 12 of the laryngectomized group were over 50 years. In comparing the incidence of cancer of the larynx during the past 25 years, there has been no apparent increase among women during the past five or 10 years in spite of an increase in the use of tobacco by this group.

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†From Department of Laryngology and Broncho-Esophagology, Jefferson Hospital.

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Carcinoma more often occurs in the decade of 50 to 59. This accounts for 247, with 178 in the 60's, 131 in the 40's, 23 in the 30's, seven in the 20's, four in the 70's and three in the 80's. The youngest was 21 and the oldest 87 years.

Habits: Smoking of tobacco often has been suggested as a predisposing factor. While a majority of the patients in this report used tobacco either moderately or excessively, nothing was shown to substantiate the belief that smoking was a predisposing factor. On the other hand, keratosis, which often is observed in excessive smokers, was noted frequently; in fact, during the past five years there has been observed a definite increase of cases of cancer with associated keratotic lesions, or cancer which was preceded by keratosis for months or even years.[2]

Occupation: The occupations of about 40 per cent of patients necessitated excessive voice use. Other than this, there was nothing significant.

Methods of Treatment: In determining the methods of treatment one must accept as fundamental that untreated cancer is a fatal disease, that the saving of life is the first consideration of therapy, and that voice impairment or loss of the larynx is of secondary importance.

It has been amply demonstrated that cancer of the larynx can be treated successfully by irradiation or removal of the growth by endolaryngeal means, thyrotomy or laryngectomy. While no attempt will be made to discuss the treatment of carcinoma by irradiation, on the basis of all the evidence available, more lives are saved by surgical treatment than by irradiation. Viewing the subject purely in the abstract, there can be no question that laryngectomy offers a greater degree of security from a life expectancy standpoint than conservative surgery or irradiation therapy, although there is much greater disability. Patients and many physicians are of the opinion that there is a choice between conservative or radical surgical treatment and irradiation with end-results about equal, irrespective of the laryngeal lesion. In our estimation the indications must be well defined for these therapeutic

measures if one wishes patients with carcinoma of the larynx to survive. Inclination too much to the side of conservatism in order to save the larynx, or a lack of courage to do a more radical operation often results in a sacrifice of the patient's life. It is generally agreed that one chance is given to cure a patient with carcinoma and this applies definitely to carcinoma of the larynx.

Indications: The indications for thyrotomy and for laryngectomy have often been discussed and should be well understood. In selecting a method of treatment, the criteria to be considered are the location and extent of the growth, disturbances in the motility of the vocal cord or arytenoid, the grade of malignancy, the presence or absence of metastasis and, finally, the condition of the patient. Although the larynx is readily accessible to mirror and direct laryngoscopic examination, a determination of the extent of the growth often is not easy and all laryngologists have been impressed that the lesion commonly is larger than appears on the surface by mirror or direct examination. In a study of carcinoma by New and Fletcher,[3] it was demonstrated that there is submucosal extension of the growth beyond apparent surface margins. In their cases the average extension was 5.5 mm. beyond the margin visible. Mackenty's statement that one should add two-thirds to the visible portion of the growth in estimating its actual size is a fairly safe rule to follow.

The studies of Broyles[4] concerning the tendinous attachment of the anterior end of the vocal cord to the thyroid cartilage and the absence of the perichondrium also must be taken into consideration in determining the plan of treatment. There also may be extension of an apparently early growth in the anterior commissure to the cricothyroid membrane or cricothyroid muscle without demonstrable metastasis to the pretracheal lymph nodes.[5]

Grading: While grading of the degree of malignancy should be considered, we do not believe that it is as important in laryngeal carcinoma as previous reports would indicate. Practically all primary carcinomas of the vocal cords and epiglottis

are of a low or intermediate grade of malignancy, while carcinoma of a ventricular band, arytenoid or subglottic region is more often undifferentiated.

Fixation of Vocal Cord: Fixation of a cord is observed when there is infiltration of its musculature by carcinoma. This is an important sign and should suggest that conservative surgical treatment probably will be inadequate. Fixation of an arytenoid indicates invasion of the cricoarytenoid articulation and the posterior larynx.

Carcinoma limited to a vocal cord without impairment of motility represents the ideal case for thyrotomy. New and Dorton[6] recommend removal of small carcinomas of the vocal cords of a low grade malignancy by surgical diathermy under suspension laryngoscopy and reported good results. LeJeune[7] advised intralaryngeal dissection of early intrinsic carcinomas of a vocal cord employing the suspension technique. These cases, too, are suitable for irradiation, but statistical evidence indicates that the number of five-year nonrecurrences following surgical extirpation is greater than those secured by irradiation. A five-year nonrecurrence rate in this type of case should exceed 95 per cent. Recurrence means incomplete removal. Lesions extending into the anterior commissure or to the anterior end of the opposite vocal cord without or with impaired motility of the vocal cord immediately increase the recurrence rate if treated by conservative surgery, even if a triangular segment of the thyroid cartilage together with portions of both vocal cords and an apparently adequate margin of surrounding normal tissue have been removed.[1]

Subglottic carcinoma usually is diagnosed late, as symptoms do not manifest themselves until the lesion extends to a vocal cord. In a review of the earlier cases it was found that thyrotomy not infrequently was followed by recurrence of the growth in the larynx, indicating that removal had been inadequate; in addition, this type of carcinoma metastasizes early to regional lymph nodes and in all questionable cases a *prophylactic block dissection* of the neck should be a part of the primary operation.

Carcinoma of the epiglottis, too, is diagnosed late. Its common occurrence near the base renders a majority of these lesions unsuitable for conservative treatment. Only three marginal lesions have been observed in the series of 633 cases and these within the past five years. There is a tendency for direct invasion of the pre-epiglottic space by epiglottic lesions; the lymphatic drainage from the base of the epiglottis and anterior extremity of the ventricular bands is carried across this space towards the thyrohyoid membrane. This type of case is best treated by laryngectomy as recommended by Bisi.[8]

Anesthesia: The method of anesthesia to be employed is a problem for the individual operator. In some of our earlier cases general anesthesia was employed, but the present procedure consists of using local anesthesia supplemented by barbiturates, both for thyrotomy and laryngectomy. For combined block dissection and laryngectomy, general anesthesia, preferably by intubation, is employed. In our experience local anesthesia is followed by fewer complications and our statistical findings indicate that the greater number of postoperative fatalities occurred during the days when inhalation anesthesia was employed.

Postoperative Mortality: Of 286 cases treated by thyrotomy, there were eight deaths, three from bronchopulmonary infections and five from cardiovascular or renal disorders. Six of these occurred in the first 44 cases treated. There have been only two postoperative deaths in the last 242 cases of thyrotomy. Among the 343 laryngectomies, there were 14 deaths, one of which was caused by postoperative hemorrhage, four by bronchopneumonia and the remainder by cardiovascular or allied conditions. In this group there also has been a diminishing mortality rate. Six deaths occurred in the first 98 cases and eight deaths in the remaining 245.

End-Results: It is difficult to evaluate end-results unless one classifies cases accurately according to anatomical locations and extent of involvement. The terms intrinsic and extrinsic are interpreted variously.[9] In an early lesion classification is easy, but in a late one it is difficult to know whether the car-

cinoma originated on a vocal cord or whether it began as a subglottic lesion. As a result attempts to localize many of the growths is largely guess work. In our opinion it is far better to analyze end-results particularly in cases of recurrence and this plan shall be carried out.

Thyrotomy: Of the group of 193 patients treated by thyrotomy that could be traced five or more years after operation, there are 117 living and free from recurrences (73.5 per cent). In addition there are alive and well for five or more years seven cases of recurrences which had been treated successfully, a total, therefore, of 124 cases (77.9 per cent).

The entire 193 cases were accounted as follows: well and free from recurrences after five years, 117; postoperative deaths, seven; intercurrent deaths within five years unrelated to carcinoma of the larynx, 21; unable to trace, six; recurrences, 42.

Obviously, the important group here is the one under the heading of recurrences. A study of these 42 revealed that carcinoma recurred in the larynx in 29 instances, and there was metastasis to regional lymph nodes without apparent recurrence in the larynx in six instances and metastasis to distant organs and structures in seven. In 23 of the 29 recurrences in the larynx, laryngectomy was performed and in six irradiation was carried out. All of the irradiated cases died. Of the 23 laryngectomies, 12 ultimately terminated fatally, 11 are living, six for more than five years following operation and five for less than five years. Of the group of six with metastasis to lymph nodes, a block dissection of the neck was performed in four, with one case living more than five years, without recurrence; the remaining five cases died, although in some irradiation was carried out.

It is of interest to note that of the 23 cases of laryngectomy performed for recurrence in the larynx, the lesion was discovered within five years after the thyrotomy in 18, and from five to 11 years after the thyrotomy in five. For statistical purposes the latter five might have been included in the five-year nonrecurrences. Reference to this will be made else-

where. In checking the location of the primary lesion in the 29 local laryngeal recurrences it was found that all had involved the vocal cords. In seven instances there was subglottic extension and in 18 there was extension to either the anterior commissure or to the opposite vocal cord. In the remaining four cases the carcinoma was limited to one cord, but there was lateral extension indicating that the lesion was larger than had been anticipated on the basis of the preoperative laryngoscopic examination.

In our estimation all of these cases were local recurrences in the larynx due to incomplete removal at the primary thyrotomy. While in one case the growth was not observed until 11 years later, the lesion was very extensive and it would be fallacious to assume that this was a primary new growth and unrelated to the original lesion removed by thyrotomy. It is evident that laryngectomy should have been the primary surgical procedure in all of these cases; in fact, we are of the opinion that local recurrence in the larynx invariably means inadequate removal and it is in these that laryngectomy should more often be considered the operative procedure of choice.

Lesions confined to the middle and anterior third of a vocal cord without extension to the opposite side, without subglottic extension or without extension into the ventricle and without fixation of the cord are suitable for thyrotomy. Certain of these may be treated by endolaryngeal measures, but the operator must be familiar with suspension procedures. Some cases of anterior commissure lesions can be successfully treated by resection of a triangular portion of the anterior part of the thyroid cartilage and a wide removal of normal tissue. In a large series of cases it will be seen, however, that this latter group more often tend to recur than do any of the others.

There are those who state that laryngectomy still can be resorted to if carcinoma recurs after thyrotomy or irradiation therapy. Our statistics do not support this thesis. Too often metastasis to regional lymph nodes or to distant structures has occurred before a local laryngeal recurrence is suspected.

Laryngectomy: Of the group of 176 cases treated by laryn-

gectomy that could be traced five or more years after operation, there are 81 living and free from recurrences (58.7 per cent). In addition there are alive and well for five or more years eight cases of metastasis that had been treated successfully, a total of 89 (64.4 per cent). The 176 cases were accounted for as follows: well and free from recurrence after five years, 81; postoperative deaths, nine; intercurrent deaths within five years unrelated to carcinoma of larynx, 23; unable to trace, six; recurrences, 57.

Following laryngectomy, the common site of metastasis is to regional lymph nodes and this occurred in 41 instances. Metastasis to the lung or mediastinum occurred in 10 cases, to abdominal organs in two and to the bony skeleton in one. There was extension downward along the tracheal wall in two cases and extension to the tongue in one. Unfortunately one can do little for these cases, the exception being metastasis to the regional lymph nodes. Of the 41 cases of metastasis to regional lymph nodes, block dissection was carried out in 21, with 10 deaths due to metastasis; seven patients are alive for five or more years and four alive for less than five years, all free from metastasis. Of the 20 cases not treated surgically by block dissection, irradiation was carried out in 16 with 15 fatalities and one living nine years. There are, then, eight cases of metastasis to the regional lymph nodes living for five or more years and four for less than five years.

No attempt has been made to classify the lesion anatomically. In one case, an epiglottic carcinoma, there was metastasis to lymph nodes. A one-stage block dissection and laryngectomy were performed during February, 1942, and there has been no recurrence for over six years. Cases with metastasis to the node on the cricothyroid membrane and those with extensive invasion of the pre-epiglottic space also have been included in this series, since the primary growth had its origin within the larynx. Cases of carcinoma involving the postcricoidal area and the pyriform sinuses have been excluded. This group presents a more radical surgical problem and this has been demonstrated by Orton.[10]

Metastasis and extralaryngeal extension seriously influence the plan of therapy and the prognosis. We believe, however, it has been conclusively demonstrated that the outloook is better if radical surgery is resorted to. Pre-epiglottic invasion by carcinoma of the epiglottis can be successfully treated with radical surgical removal of the pre-epiglottic space, and laryngectomy and a block dissection if necessary. Metastasis to the cervical lymph nodes in the region of the bifurcation of the common carotid artery does not constitute a hopeless problem. We believe the best results can be secured by block dissection and laryngectomy rather than by laryngectomy with irradiation. For a time laryngectomy and block dissection were carried out as separate procedures, but since 1942 these cases have been treated by a one-stage procedure. The first case treated in this manner, a carcinoma involving the epiglottis with metastasis to deep cervical nodes, has been referred to. Since that time a number of patients have been treated in a similar manner and the results have been gratifying.

A review of the records of cases with regional lymph node metastasis was carried out to determine the common site of the primary lesion. It was found that carcinoma of the epiglottis or of the subglottic region more often metastasized than did carcinomas that originated primarily on a vocal cord.

In the event that there is question regarding the presence of metastasis, it has been our practice to do a *prophylactic block dissection* and laryngectomy at the same time. It would be inadvisable to remove a single lymph node or do an aspiration biopsy, to determine if there is present metastasis, and it would be equally hazardous to do the laryngectomy and allow the lymph nodes to remain. Palpable cervical lymph nodes in the presence of laryngeal carcinoma may be due to lymphadenitis, but more often they exhibit metastatic carcinoma

In doing a block dissection one must be radical. The dissection should include the sternomastoid muscle, the ribbon muscles and all of the other structures excepting the common carotid artery and the vagus nerve. In epiglottic lesions which

have invaded the pre-epiglottic space, resection of the submaxillary gland often is indicated. This procedure can be carried out with safety and the results to date appear to be far better than those secured by any other method or combination of methods. The postoperative mortality rate is no greater than that of laryngectomy alone.

In conclusion, the best results in the treatment of uncomplicated carcinomas of the larynx are secured by surgical extirpation. This implies a procedure sufficiently radical to remove the entire primary lesion. One cannot be swayed by economic or emotional considerations. There can be but one real objective; namely, the saving of life. The presence of metastasis to regional lymph nodes no longer constitutes a hopeless problem. In questionable cases a prophylactic block dissection and laryngectomy are indicated. While it is true that laryngectomy sacrifices some larynges that might have been saved by thyrotomy, laryngectomy saves lives that would have been sacrificed if more conservative forms of surgery had been performed.

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NASAL SINUS DRAINAGE.
FURTHER BERNOULLI EXPERIMENTS.

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Lawrence, Mass.

Since I wrote my two papers[1,2] on the Bernoulli principle as related to nasal sinus drainage when we blow our noses, I have had opportunity to talk with many otolaryngologists concerning it.

The opinions of my confreres seem to place them in the following classifications:

1. Those who believe in Bernoulli wholeheartedly, even to the extent of discounting entirely the importance of cilia in sinus drainage.

2. Those who believe that certain individuals have the proper anatomical relationship in their own nasal air spaces for the Bernoulli principle to be effective, and that other individuals lack this ability entirely.

3. The men who believe that the Bernoulli effect is possible in almost any nose, but that the exacting conditions of constriction at the proper places makes improbable the importance of the principle as it refers to every-day sinus drainage.

4. Those who concede, for sake of argument, that the Bernoulli principle may be effective when we blow our noses, but what of it? What difference does it make in the practice of otolaryngology?

To the first group I can only express my appreciation that they have read my papers and are in agreement with my arguments. Some of the more enthusiastic members of this group, however, have become anticilia men. This is something of an embarrassment to me. They were, perhaps, unduly influenced by the semifacetious final paragraph of my first

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paper — "Finally, if it should be commonly accepted that the Bernoulli principle is effective in sinus drainage, it will take some of the load from the shoulders of the overworked little cilia."

In all seriousness, Bernoulli cannot be effective in removing mucus and mucopus from the nasal sinuses unless the mucus blanket is condensed at the sinus ostia. In all sinuses whose ostia are not situated inferiorly, this chore is almost entirely done by ciliary action alone. Thus, the cilia are essential for effective Bernoulli action.

In the second group are those otolaryngologists who informed me personally that for years they have emptied their chronic sinuses with an early morning session of nose blowing. Each expressed his satisfaction that the anatomical conformation of his own nose lends itself so admirably to Bernoulli action. The fact is that I once belonged to this group myself. It was my belief that I could empty my own sinuses by blowing my nose, which encouraged me to continue my early experiments on Bernoulli following my first series of failures. It was my expectation at that time that I would find certain types of noses so constructed that blowing would produce suction in the sinuses, and that other types of noses would not produce suction.

It is true that certain types of noses practically preclude Bernoulli action — such as those with atrophic mucous membranes and cavernous breathing spaces. The ordinary garden variety of nose, however, which is possessed by most of us, has enough erectile tissue in its turbinates to shut off our nasal passages entirely. Since this is true, there can be no question but that the proper mechanism for Bernoulli action is present.

The third group of otolaryngologists is probably much larger than I have reason to suspect from personal discussions. These are the men who do not refute the Bernoulli principle and who believe that in rare instances it may have a practical application to sinus drainage.

It is especially for this third group of readers that the following experiments are proposed. They are designed to show that one does not have to possess an ideal Venturi tube in his nose in order to exert suction at the sinus ostia when he blows his nose.

As for the fourth group, they may find some of the answer in the "Conclusions." Bernoulli may be a partial explanation of the success of many conservative rhinologists whose most radical office treatment in acute and subacute nasal sinusitis is patient shrinkage of the turbinates and a gentle packing with a simple hydroscopic agent such as argyrol. Why this latter is more effective than other agents, I do not know, but I do know that many years ago I came back to it after trying other solutions which were almost equally effective. After the packing has been in place 10 or 15 minutes, it is removed and the patient is not subjected to mass or spot suction but is allowed the satisfaction of blowing his own nose. The productive result is often surprising to patient and doctor alike; also, if the rhinologist is convinced of the efficacy of Bernoulli action, he will certainly not discourage his patients in blowing their noses, but will rather teach them how to blow them properly.

We are all aware of the difficulties of improper nose blowing, but certainly it is not necessary to instruct our patients to refrain from closing one nostril. Of course, should one nasal space be entirely blocked and the patient close his opposite nostril, the effect would be that of closing both nostrils at once, and any pressure built up on such a basis would definitely be bad for the patient's ears; but since the Bernoulli effect is commensurate with the square of the velocity of air passing through a constriction, the closure of the opposite nostril definitely facilitates the attainment of increased velocity.

I tell my patients that when they start to blow their noses, if the air passes through easily and the mucus is loose and flows easily, they are perfectly justified in blowing their noses until the mucus is expelled. If, on the other hand, they attempt to blow their noses and find them blocked, I advise them to

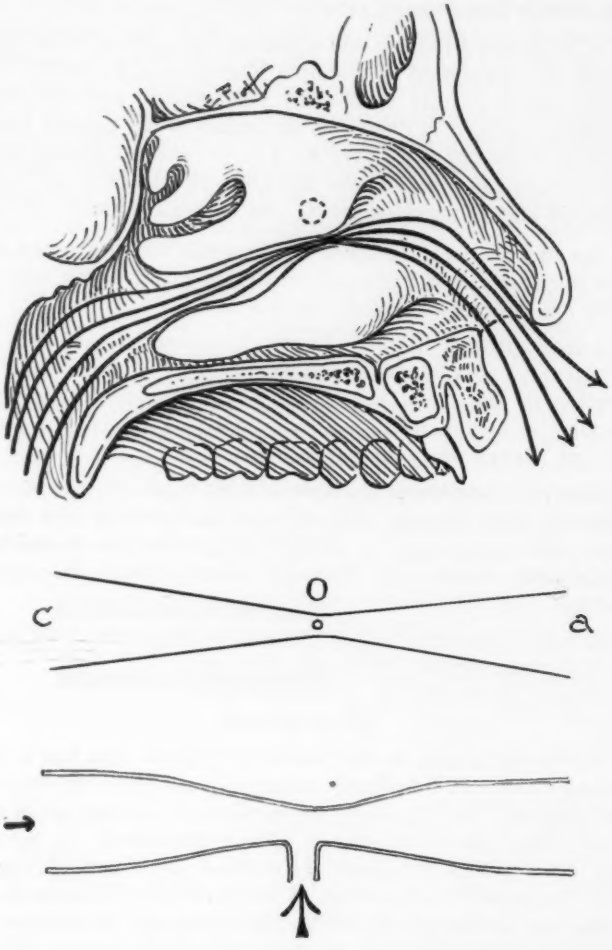

Fig. A

use a shrinking spray and wait until such time as they can blow their noses easily.

It is assumed that no one questions the suction effect at the point of constriction of a simple Venturi (or Bernoulli) tube. Such can be readily verified by reference to any elementary physics text and is discussed at length in my earlier papers. This is shown here by Fig. A. For purpose of simplicity, let us call this the *conventional* Bernoulli effect. This is the most efficient suction mechanism we can expect to find in the nose.

Let us now consider other mechanisms which are less obvious illustrations of Bernoulli constriction, but which, nonetheless, are effective in producing suction.

I shall attempt to prove by the following experiments that whenever a current of air passes abruptly from a constricted portion of the nasal passage into a wider nasal air space, suction is established for a variable distance distal to the abrupt change of calibre.

Also, an experiment shall show that, in an otherwise unobstructed nasal passage, any object which projects into the air flow, such as a crust or gob of thick, tenacious mucus or a septal spur, causes some Bernoulli effect distal to the obstruction.

A third experiment shall attempt to show what we might expect in an antrum which has two ostia.

EXPERIMENTS.

In the first place, let us visualize a patient who has a nasal passage which is completely occluded posteriorly by turbinate swelling and that the anterior portion of the passage is relatively clear. As far as this patient is concerned, his air passage on that side is completely blocked. Now, let us imagine that the posterior congestion of the turbinates subsides to the point that a thin jet of air can pass between the middle and inferior turbinates. Let us assume that the antral cilia on that side have already condensed the mucus blanket and carried it to the antral ostium, which is situated just anterior to the posterior nasal congestion.

The patient now closes his opposite nostril and blows his nose. A thin stream of high velocity air passes between the posterior portions of the middle and inferior turbinates and discharges into the wider anterior nares in the vicinity of the antral ostium. This causes diminished pressure on the nasal side of the ostium, and the normal air pressure in the antrum expels the condensed mucus through the ostium into the nasal vestibule. This process continues until the patient runs out of breath or until the mucus blanket becomes so thin that the bubble breaks or until pressure is equalized on the two sides of the ostium.

If the patient should stop blowing before the bubble breaks or before the pressure is equalized, there is a tendency for the mucus to be forced back into the sinus by atmospheric pressure, but by catching a quick breath and continuing the blow he may keep up the flow of mucus until it becomes so thin that the bubble breaks. In this case, when blowing ceases, the normal pressure is re-established in the sinus and the process may be repeated. It may be necessary, however, to wait a few moments in order to give the cilia time to again condense the mucus at the ostium.

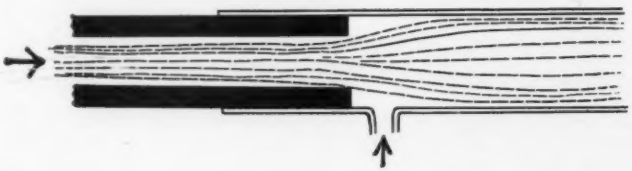

Fig. 1

Experiment 1 (see Fig. 1): The only apparatus necessary for this test is a simple glass T-tube similar to the one Proetz used in his experiments on nasal sinus pressures,[3] a U-glass water manometer and two pieces of rubber tubing. One of the pieces of tubing should be of proper size to fit snugly inside

the glass T-tube and preferably thick walled and of small calibre. The other rubber tube connects the top of the T-tube to the water manometer. (The water manometer and connecting tube are not shown in the figure.)

Insert the first rubber tube into the T-tube almost up to the tap and blow through it. The water manometer will register suction. While still blowing through the tube, gradually withdraw it. You will note that the tube may be withdrawn for a variable distance before the manometer becomes equalized. This distance will depend upon the velocity of the air jet and upon the thickness of the wall of the rubber tube — that is, upon the relative inner diameters of the rubber and glass tubes.

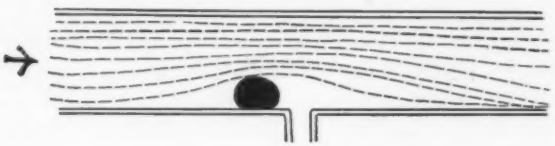

Fig. 2

Experiment 2 (see Fig. 2): The same straight glass T-tube and water manometer are used. Push a small piece of wax, plastacine or chewing gum into the tube and press it firmly against the wall of the tube just proximal to the manometer tap.

When you blow through the tube, you will see that the manometer registers suction. This is evidence that, even in an unobstructed nasal air passage, any object which stands out into the air stream affords a possible mechanism for Bernoulli action.

Experiment 3 (see Fig. 3): I call this the Hill experiment, for it was suggested by a question asked by Dr. Frederick Hill, of Waterville, Me., following my first paper on Bernoulli.

He reminded us that many antra have two ostia. He wanted to know what the Bernoulli effect would be on such an antrum. At that time I could not answer his question. The following experiment is an attempt to show what may occur.

The apparatus for this test is not as simple as the others. I had glass blowers draw out a glass Venturi tube with two taps — one tap at the point of maximum constriction and another tap half way between this and the beginning of constriction. A water manometer is connected to each tap.

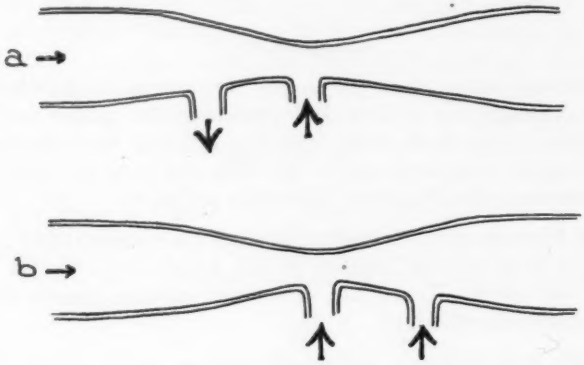

Fig. 3

Holding the tube in the position shown in Fig. 3A, blow through the tube. Pressure is shown at the first tap and suction at the second. This shows what we can expect in a double ostium antrum when the anterior ostium is located in the region of maximum constriction in the nasal air space. This would appear to be an ideal mechanism for clearing out any condensation of mucus in the vicinity of the anterior ostium. It should be noted that air passes into the antrum

through the posterior ostium and flows out of the antrum through the anterior ositum.

Reversing the glass tube as in Fig. 3B and again blowing through it, one will find suction at both taps with the highest suction at the tap of most constriction. This is a less ideal mechanism for sinus drainage.

One can readily visualize various positions of ostia between these two extremes and the probable Bernoulli effect in the antra which have double ostia.

CONCLUSIONS.

Bernoulli action does not in any way supplant the cilia in sinus drainage, but is dependent upon them for proper feeding of mucus to the sinus ostia. The cilia institute sinus drainage by bringing sinus secretion to the ostia and then the drainage mechanism is facilitated by Bernoulli action.

The Venturi conformation of the nasal air space is the most efficient in producing suction in the nasal sinuses when we blow our noses. There are other less obvious mechanisms which are also effective.

There is no nasal air space conformation which affords suction effect to all of the sinus ostia at the same time, but the erectile turbinates make the cross-section of the air space so variable that it is difficult to imagine any combination of nasal congestion which does not contribute to suction at some sinus ostium.

It is true that some noses may be so constructed that they lend themselves more readily than others to Bernoulli action; however, any nose which is not so atrophic that its turbinates cannot produce partial nasal obstruction is capable of producing suction in the sinuses.

The almost constant variability in the size and shape of the nasal air passages explains why nose blowing is at times disappointing and at other times satisfying, and on occasion surprisingly productive.

No intranasal operation should be attempted which might in any way preclude the physiological Venturi conformation of the nasal air passages.

If one is convinced that Bernoulli is effective in nasal sinus drainage, he will not forbid his patients to blow their noses, but will instruct them how to blow them properly.

It can also be readily understood that if one has a nasal constriction in the region of the antral ostium, a forceful inspiratory effort, which reverses the air flow, produces a double action suction effect on the posterior ethmoid and sphenoid ostia. This explains the occasional necessity for the inelegant, but often satisfying, practice of snuffing, hawking and spitting.

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AMERICAN BOARD OF OTOLARYNGOLOGY.

The American Board of Otolaryngology will conduct an examination in Chicago at the Palmer House, Oct. 4 to 9, 1948. For further information, write to Dr. Dean M. Lierle, Secretary-Treasurer, Iowa City, Iowa.

PART I.

ALLERGY IN OTOLARYNGOLOGY.*

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II. — THE ALLERGIC INVESTIGATION, HISTORY TAKING, SKIN TESTING AND DIAGNOSIS.

W. BYRON BLACK, M.D.,
Kansas City, Mo.

III. — ALLERGY IN OTOLARYNGOLOGY. ALLERGIC MANAGEMENT — TREATMENT.

REA E. ASHLEY, M.D.,
San Francisco, Calif.

Because of the limited time devoted to this joint paper, many of the detailed aspects of this subject cannot be considered. The following outline is presented with the idea of pointing out some of the various problems which confront the otolaryngologist from the standpoint of allergy. The most important matters are related to diagnosis, differential diagnosis and treatment. The nose and paranasal sinuses are considered from the standpoint of symptoms, rhinoscopic examination, the cytologic examination of the secretions, X-ray of the sinuses, and the bacteriologic and the pathologic findings. The diagnosis of respiratory allergy in children and the relationship of the tonsils and adenoids will be discussed in relation to diagnosis and treatment. Finally, the all-important question of the indications for surgical interference on the sinuses and the relation of sinus disease to asthma will also be considered.

THE NOSE AND PARANASAL SINUSES.

Although a great variety of conditions must be considered

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in the diagnosis of nose and paranasal sinus disease, those most frequently encountered may be included under the classifiication of: *1.* allergy, *2.* allergy with secondary infection, or *3.* suppuration. Allergy is by far the most common of all. Accurate diagnosis is dependent upon the correlation of the following factors:

1. Symptomatology.
2. Rhinoscopic examination.
3. Cytology of the secretions.
4. X-ray examination.
5. Bacteriology.
6. Pathology.
7. General clinical history, examination and laboratory findings.

THE SYMPTOMATOLOGY.

The most common symptoms of which the patient complains consist of sneezing, obstruction, discharge and itching. In the ordinary case of nasal allergy, these sypmtoms are outstanding. Itching is not always present. Intermittent attacks are not infrequently confused with frequent colds. Isolated attacks of allergy may go unrecognized as such. For example, the patient who has a cold every year in March may have tree hay fever. In a significant number of patients, sneezing may be uncommon or absent, in which instances the patient complains of nasal obstruction and discharge. Nasal obstruction or stuffiness only may be caused by allergy or by mechanical obstruction from deflection of the septum. Nasal symptoms simulating allergy may be due to the prolonged use of nose drops. They may be caused by the inhalation of chemicals, smoke, gases or nonspecific dusts. Other pathologic conditions which involve the nasal mucosa must be differentiated from allergy. The complaint of sinus headache with nasal obstruction and discharge especially when unilateral may be the counterpart of an attack of histaminic cpehalgia.

THE RHINOSCOPIC EXAMINATION.

The observations made as the result of rhinoscopic exami-

nation should be correlated with the symptomatic history. In typical cases of nasal allergy, the mucosa appears pale, grayish, boggy or swollen. It may be boggy and swollen, but with a color approaching normal. Occasionally it may appear somewhat reddened. Pale, edematous swelling may be noted in the middle meatus. Varying degrees of polyposis may occur, almost always bilateral, but not infrequently unequal in degree. For purposes of record, the following grading of these changes is suggested: *Grade I*, beginning polyposis in middle meatus. *Grade II*, middle meatus filled to lower border of turbinate. *Grade III*, extension to upper border of inferior turbinate, and *Grade IV*, nose completely obstructed. Intermediate grading may be recorded by the addition of a plus sign. Grades III and IV may be confined to the entire nose, or only the anterior, middle or posterior portions of the nasal cavity, consequently should be recorded as such. Edematous polyps do not form on the septum or the turbinates. Allergic papillary growths, however, may appear on the inferior turbinate or on the septum and floor near the nasal vestibule. Non-allergic polyps are almost always unilateral and are designated as choanal or myxomatous, inflammatory, fibromatous or malignant in type. Allergic polyps are rare in children before the age of puberty. In the nasal cavities, secretion is not infrequently observed. Its location and color should be recorded. Deflections of the septum should be recorded as to extent, location and the degree of obstruction produced. The degree of mechanical obstruction, however, may be exaggerated by the addition of allergic swelling of the overlying mucosa.

THE CYTOLOGY OF THE NASAL AND SINUS SECRETIONS.

Although the diagnosis of various conditions of the nose and paranasal sinuses may be diagnosed definitely or tentatively upon the basis of symptomatology and rhinologic examination, there are many instances in which further examination or laboratory procedures must be conducted. Because of the fact that the most common affections of the nose and paranasal sinuses are confined to allergy and to the infections, the

most important and perhaps the most common laboratory procedure employed is that of the determination of the cytologic picture of the nasal and sinus secretions. In uncomplicated allergy, the cytologic picture is that of a pure eosinophilia. The infections are characterized by a neutrophilia. In allergy with complicating infection, the cytologic picture is that of a mixed eosinophilia and neutrophilia. In view of the importance of this examination, this phase of the subject should be considered in detail.

PREPARATION OF SMEARS.

It is quite often impossible to draw conclusions from the examination of a single smear of secretion; therefore, it may be necessary to make an examination of several smears, especially if the specimen does not contain sufficient material or if acute or chronic infection complicates the picture. In the collection of secretion from the nose for smear examination, several methods may be employed. Specimens may be taken separately from each side of the nose. Secretion is most easily and readily collected by having the patient blow the nose on a waxed paper or cellophane handkerchief. This gives a specimen which represents only nasal secretion or a collection of both nasal and sinus secretion. Small crusts from the septum and vestibule of the nose should be avoided. If no secretion is available from blowing the nose, it may be necessary to remove it by swabbing it with a cotton applicator. Secretion may also be collected in a specimen bottle at the time of an acute exacerbation. It may be necessary to centrifuge. A small mass of mucus selected from the specimen, however, may be satisfactory. The insertion of a saline tampon into the nose may stimulate the flow of secretion so that sufficient material may be obtained. Secretion from the individual sinuses may be obtained by aspiration or by puncture and washing, or from specific areas in the nasal cavities by aspiration. Gross masses of secretion may be used for smears or the returned fluid may be centrifuged if no gross mass of material is available.

Cytologic Picture of Nasal and Sinus Secretions in Allergy and Infection

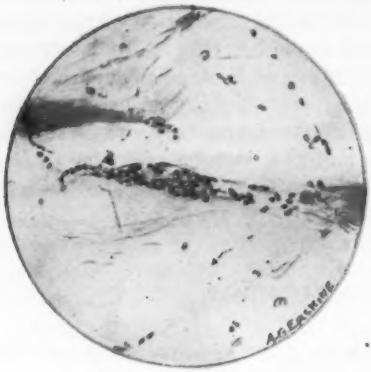

Fig. I

Eosinophiles 1 plus. Small clump of eosinophiles, diagnostic of *nasal allergy*.. Clumps of this type are often noted in thin, watery secretions.

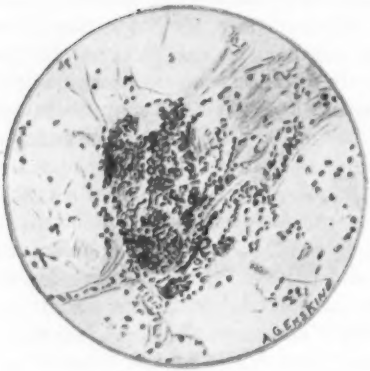

Fig. II

Eosinophiles 2 plus. Clump of eosinophiles with occasional neutrophiles, as found in small mass of mucoid secretion.

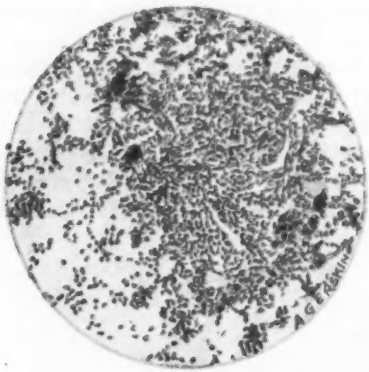

Fig. III

Eosinophiles 4 plus. Large clump of eosinophiles, commonly seen in *nasal allergy* without complicating infection.

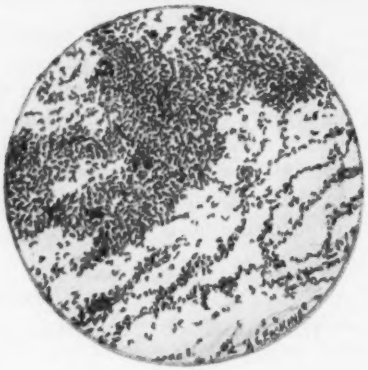

Fig. IV

Eosinophiles 1 plus, neutrophiles 3 plus. Large number of neutrophiles with small number of eosinophiles, diagnostic of *nasal allergy* with acute or chronic infection. (Compare with Fig. V.)

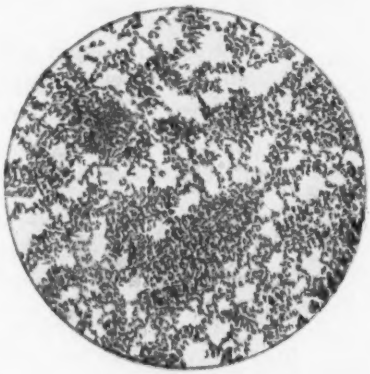

Fig. V

Eosinophiles plus-minus, neutrophiles 4 plus. Collection of neutrophiles with only occasional eosinophiles. This picture characteristic of the common cold in normal individuals or in cases of chronic sinusitis. May be present also in nasal allergy with superimposed acute infection. Eosinophiles *not diagnostic of allergy.*

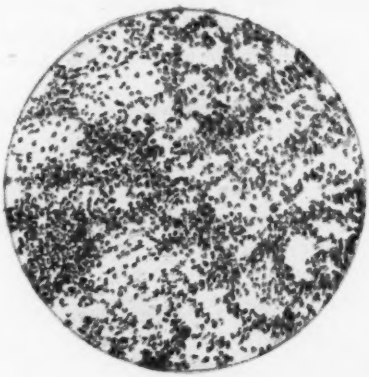

Fig. VI

Eosinophiles 2 plus, neutrophiles 2 plus. Many eosinophiles and neutrophiles. This picture observed in *nasal allergy,* (1) in resolution stage of acute infection, (2) with marked nasal obstruction (stagnation), (3) with nasal polyps, or (4) in chronic infection (usually with polyps).

TECHNIQUE OF STAINING SMEARS.

In the preparation of nasal smears for microscopic examination, we have used various types of blood stains, chiefly Wright's and Giemsa. On the whole, they proved to be unsatisfactory. In 1940, we developed an eosin-methylene blue stain which remains stable for an indefinite period of time. Stained specimens do not fade and the technique has been perfected so that only one minute is required to prepare the specimen. This technique is outlined as follows:

HANSEL'S STAIN TECHNIQUE.

(FOR NASAL, CONJUNCTIVAL AND BRONCHIAL SECRETIONS.)

1. *a.* Collect nasal secretion by having patients blow nose on waxed paper.

   b. Postnasal secretion may be collected by patient and delivered in clean bottle, or may be aspirated with a suction cannula.

   c. Bonchial secretions may be expectorated or coughed into clean bottle.

   d. Conjunctival smears should consist of mucus material usually obtainable from inner canthus. Watery type tears generally do not show any cells.

2. If secretion is scattered on waxed paper, use end of slide to scrape secretion to a central point, then, holding paper in left hand with one finger under secretion, pass slide over it for smear, and it will adhere. Staining will be better if secretion is teased out with toothpick or forceps. Prepare two or three slides if there is enough secretion.

3. Dry smears in air or gently over flame. Mark across slide next to label with paraffin stick to prevent overflow of stain.

4. Cover completely with Hansel's stain and allow to stand

30 to 45 seconds, giving the longer period of time to thicker or milky smears.

5. Add distilled water to take up stain as in Wright's technique and allow to stand 30 seconds. Pour off stain and flood slide with distilled water to remove excess stain.

6. Flood slide with 95 per cent ethyl or methyl alcohol. Drain off and dry slide over flame. Wipe back and edges of slide with piece of wet paper towel to remove excess stain.

7. *Caution:* If alcohol is left on too long, or used to excess, it will wash the blue stain out of the neutrophiles and cause them to appear pink. Pink neutrophiles present a clear, homogeneous cytoplasm. There are no true granules in the neutrophile and it should be readily distinguishable from the eosinophile which stains definitely red with deep red granules and a prominent blue nucleus. Free red granules often appear from broken eosinophiles.

8. In the examination of smears, the magnification should be 125 to 150; using a 10× objective, the eyepiece, therefore, should be 12.5 to 15×. Use a moderately strong, clear, colorless light. Do not use a blue filter in lamp. Keep substage light shutter open. With the newer binocular scopes a magnification of 100 may be satisfactory. For high power examination, specimens must be mounted with a cover slip. Mounted specimens will also keep indefinitely without fading.

9. *a.* Stain for current use should be kept in amber bottle, 30 cc. dropper type.

   b. Stopper should be turned when not in use to prevent evaporation.

   c. Alcohol and water should be kept in clear 60 cc. bottles of dropper type.

d. Contact of stain, alcohol or water with rubber may result in chemical contamination.

INTERPRETATION OF SMEARS.

In the interpretation of the cytology of the secretions, one must take into consideration the type and quantity of secretion in the specimen and correlate the findings with the clinical history and nasal changes. The clinical type of allergy under consideration and the possible relationship of acute and chronic infection must always be evaluated. An appreciation of the significance of the cytology of secretion can be accomplished only by individual experience, and then only after the examination of many hundreds of specimens. If this work is done by a laboratory or by a technician, the clinician sacrifices the real value of the cytologic findings, for individual interpretation must be correlated with all the clinical facts.

In the inspection of a smear, one containing only eosinophiles, for instance, it will be noted that the cells are irregularly distributed. Sometimes they are scattered, arranged in clumps, or arranged in streaks (see Plates 1, 2 and 3). When mixed with neutrophiles, they may likewise be irregularly distributed (see Plates 2 and 4). Only certain parts of the slide may show significant areas. It is not unusual, for instance, to find a slide completely covered with neutrophiles except in certain small areas where eosinophiles are clumped in masses (see Plate 4).

In recording the cytologic findings, the question arises as to what percentage of eosinophiles constitutes a diagnostic number. In view of the irregularity of distribution, it is often not possible to make an accurate evaluation in terms of percentages. One can learn only by individual experience how to evaluate the cytology. In making a record of the cytologic findings on the history, the best method is the use of the terminology, as commonly employed in recording the results of skin tests. We have adopted the plan, therefore, of recording

the cytologic findings in terms of plus-minus, 1, 2, 3 and 4-plus eosinophiles and/or neutrophiles. Although many epithelial cells may be noted in specimens, we have attached no definite significance to them. In using this plan of recording the cytology, due consideration must be given to the type of specimen under examination. A scanty amount of secretion may show a small but significant number of eosinophiles, while a good specimen may show a 4-plus number. Plates 1 to 6 illustrate six representative smears.

The presence of significant numbers of eosinophiles in the secretions during quiescent, apparently symptom-free periods, indicates that mild reactions may occur in the mucous membrane without definite symptoms. Patients, therefore, with almost symptom-free seasonal and nonseasonal allergy and with symptom-free asthma may show eosinophiles in the nasal secretions at all times. During quiescent periods, between exacerbations, a large percentage will show no typical changes in the nasal mucous membrane. The membrane may appear quite normal.

In secretion containing both eosinophiles and neutrophiles, the latter represent superimposed acute or chronic infection (see Plates 4, 5 and 6). In evaluating the number of neutrophiles in the secretion, one must take into consideration that the neutrophilic response is always greater than the eosinophilic response and that the number of neutrophiles usually outnumbers the eosinophiles about 10 to 1. A 1-plus number of neutrophiles represents about 10 times as many eosinophiles. In a smear with 4-plus neutrophiles, the field is completely covered with them (see Plate 5).

TONSILLECTOMY AND RESPIRATORY ALLERGY.

In view of the similarity of the symptoms of respiratory allergy and colds, bronchitis and sinusitis, a definite primary diagnosis is often not established in the management of these cases. The diagnosis of some types of respiratory infection is

often made with the advice of removal of the tonsils and adenoids. In the analysis of the group of 455 cases previously reported, it was apparent that a consideration of tonsillectomy was frequently the primary factor. The incidence of the various types of respiratory allergy which we observed was greatly influenced by this factor alone. We feel that many patients with respiratory allergy, especially perennial nasal allergy and hay fever, are subjected to this operation without the recognition of the allergic manifestations. In this series, a study of 341 cases of respiratory allergy, we felt that the incidence of pure nasal allergy was too low, and the incidence of hay fever, hay fever and nasal allergy, and asthma was too high. Patients with frank bronchial asthma are easily recognized as such, but the other types are frequently overlooked. Although there are definite indications for tonsillectomy in a great many patients with respiratory allergy, this operation should not be performed primarily for the relief of allergic symptoms.

That this contention is true was well established by an analysis of a group of routine patients who entered the clinic during the summer of 1938 for a consideration of removal of the tonsils and adenoids. Two hundred such patients were specifically studied to determine the incidence of respiratory allergy among them. These patients were observed during July, August and September, 1938. Of the 200 patients, 104 were male and 96 female. The ages varied from three to 16 years. Among the 200 patients, 26 proved to have nasal allergy, an incidence of 13 per cent. Of the 26 positive cases, the local nasal symptoms were typical in only 13 instances.

ROENTGENOGRAPHIC EXAMINATION OF THE PARANASAL SINUSES.

The information obtained from a comprehensive roentgenographic examination of the sinuses when correlated with the clinical history, the nasal examination and the laboratory findings, is of indispensable value in determining the nature and extent of the pathologic changes in these structures.

Although a variety of pathologic conditions may be disclosed by an X-ray examination, the most commonly encountered conditions concern acute or chronic suppurative sinusitis, allergy or a combination of allergy and infection. In chronic sinusitis there is a reaction in the bone in the form of an osteitis. In chronic ethmoiditis, there is a sclerosis of the cell paritions. In chronic polypoid ethmoiditis, the cell partitions are decalcified. In the allergic cases, the generai appearance is one of a lack of contrast, with no clear-cut detail of blackness in the entire sinus area. The ethmoid cell partitions may be entirely decalcified. The film may show a milk, washed, noncontrasting appearance. There is no reaction in the bone as seen in chronic purulent sinusitis.

In the past, most rhinologists placed a great deal of importance upon the X-ray findings in making a decision as to operative interference. With a more general appreciation of the part that allergy plays in sinusitis today, the X-ray is used more as an adjunct in diagnosis. The literature is replete with articles on the value of X-ray diagnosis in sinusitis. In many reports the X-ray changes were confirmed or not confirmed at operation. On the whole, the limitations of X-ray diagnosis must be appreciated.

When the X-ray findings are carefully correlated with the clinical history, the nasal examination and other laboratory data, especially those concerning the cytologic and bacteriologic analysis of the secretions from the nose and paranasal sinuses, they may be more accurately evaluated. The practice of basing operative indications upon X-ray findings alone cannot be too strongly condemned. The transitory nature of the edema which occurs in the mucosa of the sinuses in allergy adds to the unreliability of the X-ray examination. Marked changes noted in the film at one time may be markedly reduced or absent at another time. Repeated examinations with or without the use of radiopaques may be necessary to determine the extent of permanent changes. An X-ray examination made during an acute exacerbation of symptoms may show

much more pronounced changes than when made during a period of quiescence or after improvement resulting from adequate allergic management. Similar variations may occur, according to the presence or absence of acute infection.

BACTERIA IN ALLERGY AND IN INFECTIONS OF THE PARANASAL SINUSES.

It is generally conceded that bacteria play the important part in the acute and chronic suppurations of the sinuses and that infection not infrequently complicates the allergic picture, but the question of bacterial atopy as such is still an unsolved problem.

Comparatively few studies on the bacteriology of the sinus secretions and the sinus membranes have been reported. In 1931, Kistner reported his observations on the histology and bacteriology of 400 cases of sinusitis of the hyperplastic or nonsuppurative type. Positive cultures were obtained in 94.5 per cent of the cases and the streptococcus was the predominating organism.

In 1940, Grove and Farrior reported their observations on a group of 200 operative cases of so-called hyperplastic sinus disease. Eighty per cent of the patients had bronchial asthma. Three hundred sixty-five cultures were made of washings from sinuses, over 90 per cent of which came from the antrum. One hundred thirty cultures were made from the membranes removed from the ethmoid and sphenoid sinuses, and 108 from the antrums. Some type of staphylococcus was by far the most frequent organism encountered in the sinus washings as well as in the membranes. Hemolytic streptococci were found more frequently in the antral membranes than in the washings or in the ethmoidal or sphenoidal membranes. Ninety-five per cent of the antral membranes and 80 per cent of the ethmoidal membranes showed bacteriologic evidence of infection, or an average of 87 per cent of the total group.

On the basis of these bacteriologic studies, it is evident

that infection is the rule rather than the exception in cases of this type. In the evaluation of studies of this type it is important that acute or subacute stages of infection be ruled out, for in these instances bacterial cultures should be about 100 per cent. This can be done accurately only by cytologic studies of the secretions. In view of the fact that some pathologic changes occur in the sinuses in practically all cases of nasal allergy, it would appear, consequently, that in almost all cases there is bacterial contamination. Be that as it may, the question arises as to whether the bacteria present are saprophytic or pathogenic; furthermore, it may also be a question as to whether the existing pathologic changes are reversible or irreversible. Certainly where irreversible changes exist, infection should become more permanently established. Assuming that allergy is characterized by eosinophlia of the tissues and secretions and that neutrophilia characterizes infection, it has been our experience that a neutrophilia in the absence of eosinophilia, which should designate a suppurative process, is very rare in the paranasal sinuses. Localized suppuration in the sinus membranes could be demonstrated, however, only by microscopic examination of these tissues. Grove states that in his cases neutrophilia was infrequently observed.

In a large percentage of the cases with these pathologic changes and bacterial contamination of the sinuses, there is no associated bronchial asthma. In those instances in which asthma is present, must it be assumed that these changes are the cause of the asthma? In view of the facts, they could be only of secondary importance. This subject will be discussed further as a part of the indications for surgical interference in respiratory allergy.

PATHOLOGIC TISSUE CHANGES IN ALLERGY.

According to the recent observations of Kline, allergic reactions are characterized by rapid onset, violent course and slow regression. The tissue changes vary from no detectable altera-

tion to inflammatory, proliferative, severe degenerative, and necrotic lesions. In general, the tissue changes correspond to the severity of the signs and symptoms of the reactions, except in smooth muscle in anaphylactic shock.

It was previously pointed out by Kline and Young that the tissue changes in allergy may be of the reversible or the irreversible type. Repeated acute reactions in the nose and paranasal sinuses may be of the reversible type. This is particularly observed in seasonal hay fever. Long continued reactions, however, often result in tissue changes of the proliferative and eventually the degenerative type, which may be partly reversible, but mostly irreversible in nature.

Although the tissue changes in the nose and paranasal sinuses more or less parallel the severity of the symptoms, there are many instances in which this is not true. For example, there may be very severe symptoms, even over a long period of time, without the development of gross edema and polypoid changes. On the other hand, nasal and sinus polypoid changes may be present in instances in which the symptoms are of comparatively mild degree.

There must be some inherent relationship between the allergen and the reactability of the tissues to account for this lack of parallelism. In children, gross edema and polyposis are rare before the age of puberty. What is the reason for this?

Upon direct inspection and palpation of nasal polyps, it is sometimes possible to evaluate the possible degree of reversibility or irreversibility.

Highly edematous, watery appearing polyps are more likely to be reversible, while those which are firm and appear fibrous may be only partly, or not at all, reversible. The degree of edematous and/or proliferative changes may be more accurately determined by microscopic examination. The same conditions apply to the changes in the mucosa of the sinuses.

Degenerative changes are likely to be more pronounced in the latter.

By repeated observation of the nose and X-rays of the sinuses while the patient is under allergic management, it is frequently possible to determine what changes for the better are likely to result. With marked improvement or abatement of the nasal symptoms and local reactions, there should be a very definite and marked recession of the changes in proportion to their degree of reversibility. Nasal polyps may, therefore, disappear entirely, partly, or not at all. In the paranasal sinuses, these factors would have to be determined by X-ray examinations. After surgical intervention, they may be definitely and accurately determined.

LOCAL TREATMENT OF THE NOSE AND PARANASAL SINUSES.

In the management of the nose and paranasal sinuses, various conditions arise or exist which require some form of local treatment. For symptomatic treatment, nose drops containing vasoconstrictor drugs are used much less frequently now than formerly, for it has been learned that their continued use, especially the synthetic preparations, leads to chemical irritation and an aggravation of symptoms. More satisfactory relief may be obtained from the oral administration of ephedrine-like compounds or the antihistaminic drugs.

When the common cold occurs, the local use of such drugs, with the addition of antibiotics or sulfa preparations, may be temporarily advisable. In some instances, they appear to be of definite benefit — in others, they do not appear to be of any value whatsoever. In general, the parenteral administration of these preparations appears to be more effective, particularly in the subacute stages of the infection. When acute sinusitis complicates the picture, it may be necessary to employ shrinkage and suction or lavage of the antrums, and in the instillation of antibiotics. With the general administration of antibiotics, this is necessarily less frequently than formerly.

INDICATIONS FOR SURGICAL INTERFERENCE IN ALLERGY OF THE NOSE AND PARANASAL SINUSES.

Before allergy was generally appreciated as an important cause of the disease of the nose and paranasal sinuses, the adage prevailed that "once a sinus patient, always a sinus patient." Certainly this is no longer true today, for about 90 per cent of the patients who consult the otolaryngologist with the statement, "I have sinus trouble," have allergy.

Although a great deal has been accomplished in the diagnosis and treatment of allergic diseases during the past 25 years, very little progress has been made in preventive allergy, insofar as the elimination or avoidance of, for example, inhalant factors such as house dusts, occupational dusts, and pollens is concerned. If it were possible to contact all allergic patients at the very onset of symptoms, especially the respiratory types, it should be possible to prevent, in a very significant percentage of the cases, the development of permanent pathologic changes in the nose, the paranasal sinuses and the bronchi.

When these pathologic changes do occur in the upper and the lower respiratory tract, they are one and the same pathologic process. Then it is a question whether the process is reversible or irreversible, and to what extent secondary infection has been superimposed. When irreversible changes occur in the nose and paranasal sinuses, some form of surgical interference is usually necessary. When the patient has bronchial asthma, the question arises as to the influence of these changes upon the asthma. To say that the nasal and paranasal sinus changes cause asthma primarily is not an acceptable theory today among most observers. Practically all otolaryngologists who have had the experience of cooperating with the allergist agree that whenever pathologic changes occur in the nose and paranasal sinuses, which are a detriment to improvement or recovery, surgical interference is indicated, regardless of whether or not the patient has bronchial asthma. In those who do have asthma, the proper treatment of the upper respiratory tract often improves the general condition

of the patient to the point where he is more responsive to allergic management. Any apparent direct improvement must be considered as the result of nonspecific or shock therapy. It is generally known that when the asthmatic patient has a sufficiently long symptom-free period, in which his general and nutritional status improves, he is apparently less allergic and does not so easily lapse into the asthmatic state again.

In those instances, for example, in which all diseased tissue is removed from the nose and paranasal sinuses by surgical interference, what assurance does the patient have that all previous tissue changes will not recur unless adequate control of the allergic factors is instituted? In other words, when the local disease has been eradicated, every effort must be made by allergic management to prevent the recurrence of the pathologic changes. It is only by this plan of management that we may anticipate or hope for a possible cure, at least control and prevention of a recurrence of the old status.

When the patient seeks relief of nasal allergy, the most distressing symptom of which he complains is inability to breathe through the nose or nasal obstruction. This is caused by swelling of the mucosa, nasal polyps and/or deflection of the septum. Swelling of the nasal mucosa may be reduced temporarily by the administration of ephedrine or antihistaminic drugs. More lasting relief, however, must come from satisfactory allergic management. If nasal polyps do not undergo resolution, they must be removed. If a deflection of the septum is causing definite obstruction, it should be corrected. If the allergic factor is not controlled, swelling of the mucosa persists and nasal polyps recur. Although the septal deflection may have been corrected, nasal obstruction still persists because of the swelling of the mucosa. In those instances in which allergic management has not been successful, other procedures have been adopted to relieve obstruction, such as cauterization, electrocoagulation or the injection of escharotics into the inferior turbinate. Ionization has also been employed with variable success. The local application of radium or X-ray treatments have been used with temporary

relief. A patient with distressing obstruction is willing to have almost anything done to get relief.

When pathologic changes of significant degree occur in the paranasal sinuses, their alteration will usually parallel those in the nose. When good results are observed in the nose, there should be improvement in the sinuses, and usually there are no indications for surgical interference, unless marked irreversible changes persist in them. If allergic management fails, the surgical end-result is usually unsatisfactory.

In the otolaryngologic literature, the reports on the end-results of surgical interference vary from a small percentage to almost 100 per cent. Most observers emphasize the thoroughness and completeness with which the operations should be performed. Similar reports on the end-results of sinus surgery in asthma have also been presented. In comparatively few instances was there cooperation between the otolaryngologist and the allergist in the selection of cases and the evaluation of results. The general consensus of opinion among those observers is similar to that expressed by Woodward, who states that:

"It is a matter of record that sinusitis does frequently occur in asthma and that these patients do improve after the infection has been cleared. The degree and duration of improvement vary widely in published case reports and seem to be directly proportionate to the completeness of the diagnosis and treatment."

According to the observations of Grove, an intelligent analysis of the effect of sinus surgery in asthma must include accurate information as to whether the asthma is due to infection, infection combined with sensitizations or to sensitization alone. In the latter group, he feels that operation is not necessary to cure the asthma. In those selected for operation, he emphasizes that the complete elimination of disease tissue as much as possible is absolutely necessary. Among those subjected to operation, Grove obtained the best results in the combined type of asthma. In these cases, the infection is often considered as a secondary factor. In this group, all

patients were under allergic management. In general, the best results were obtained among the patients from 31 to 50 years of age, and in whom the asthma had been present from five to 10 years.

Upon due consideration of all the factors which must be considered in the selection of patients for surgical intervention, it is evident that general rules rather than specific ones must be adopted and that individualization of cases must be followed. In most instances, the pathologic process is one of a combination of allergic changes and secondary infection. True suppuration, in the absence of eosinophilia, is the exception. As the result of repeated acute infections, true suppuration may become established only in certain specific sinuses, especially the antrums and the ethmoids. Since dental infections may not infrequently extend into the antrum, this possibility must not be overlooked. We have encountered a significant number of these cases in which, for example, a foul-smelling purulent discharge on one side of the nose was the result of such an occurrence.

BRONCHOSCOPY IN ALLERGY.

There are many instances in which bronchoscopy is a definite adjunct in the diagnosis and treatment of bronchial asthma. In status asthmaticus, the aspiration of thick, viscid mucus by bronchoscopy may be a lifesaving procedure. In some cases the aspiration of secretions for cytologic examination and culture is necessary to establish a definite diagnosis. Tumors, foreign bodies and other lesions in the bronchi may give rise to asthma-like symptoms, the cause of which may be determined only by bronchoscopic examination.

ASSOCIATED ALLERGIC MANIFESTATIONS.

Although the allergic process may be confined to the nose and paranasal sinuses, other manifestations, besides hay fever, such as bronchial asthma, gastrointestinal allergy, various types of skin allergy and allergic headache, may be associated with it and must be considered in diagnosis and treatment.

MISCELLANEOUS MANIFESTATIONS.

In addition to allergy of the nose and paranasal sinuses, other manifestations may involve the eye, ear, mouth, pharynx, larynx, salivary glands or other regional structures.

CONCLUDING REMARKS.

After due consideration of allergy from the standpoint of otolaryngology, it is evident that there should be no difficulty in establishing a diagnosis and eliminating those conditions which may simulate allergy or may be associated with it. In the management of the allergic patient, it is apparent that for most satisfactory results, there must be close cooperation between the otolaryngologist and the allergist; furthermore, there must be some established agreement as to what procedures are necessary and which are best for the patient when his problem is considered from both standpoints.

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PART II.

THE ALLERGIC INVESTIGATION; HISTORY TAKING, SKIN TESTING AND DIAGNOSIS OF THE OTOLARYNGOLOGIC PATIENT.

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The investigation of the allergic patient is dependent upon a thorough and complete knowledge and evaluation of the various types of the allergic factors involved. After this investigation the diagnosis is made of the type or types of allergy the patient may have. The management and treatment is then instituted.

The various types of allergy may be classified or designated according to the etiologic factors, the anatomic site involved or the type of reaction. The following clinical classification is the one usually followed:

Group A:

I. Respiratory Allergy
- *1.* Hay Fever or Pollen Allergy
- *2.* Nasal and Sinus Allergy (Perennial)
- *3.* Allergic Bronchitis
- *4.* Bronchial Asthma

II. Gastrointestinal Allergy

III. Urogenital Allergy

IV. Skin Allergy — Urticaria, Angioneurotic Edema, Eczema, Purpura

V. Allergic Headache

Group B:

I. Serum Disease or Serum Allergy

II. Contact Allergy

III. Bacterial Allergy

IV. Physical Allergy

HISTORY TAKING IN ALLERGY.

In order to institute allergic management on a rational basis it is extremely important to begin with a complete detailed clinical history of the patient's symptoms. It is needless to emphasize that a thorough knowledge of the possible etiologic factors is also necessary. The following outline or one similar to it is suggested as a guide in obtaining the pertinent information:

HISTORY OUTLINE.

Chief Complaints:
Nasal Allergy, Cough, Asthma.
G. I., Headaches.
Skin: urticaria, angioneurotic edema, eczema, contact dermatitis.

Past History:
Infantile Colic, Urticaria, Eczema.
G. I., Skin, Headaches.
T and A, Acute Infections and Other Diseases.
Operations.

Family History of Allergy:
Parents, Brother and Sister.
Grandparents, Maternal and Paternal.

Present Illness:
Onset: Date, Month, Year.
Sudden or Gradual.
Residence or occupation at time.
Changes of environment.
New furniture, clothing, or other articles.
Unusual circumstances or contacts.
Unusual drugs or foods.
Pollen Seasons.
Other Manifestations of Allergy.
Acute infections: colds, la grippe, acute infectious diseases or other diseases.
Infancy, childhood, puberty, pregnancy, menopause:
Endocrine Disturbances.

Course:
Symptoms constant or intermittent.
Analysis of acute exacerbations or periods of relief.
Vacation, business or pleasure trip.
Change of occupation.
Change of residence.
Hospital Admission.
Food, Drugs, Serums, etc.

Relation of attacks to:
Season: Spring, Summer, Fall, Winter.
Pollens and Seasonal Foods.
Changes of residence or occupation.
Unusual inhalant contact.
Time of Day.

Environment (Home):
Bedroom, living room, kitchen, basement.
Pillows, mattress, bed coverings, draperies, rugs, rug paddings, overstuffed furniture, cosmetics and toilet articles.
Plants, Insecticides, Dogs, Cats, Birds, Toys.
Neighborhood: grasses, weeds and trees.
factories, stables, etc.
Sports: Inhalant contact.
Automobiles: cushions and upholstery.
Occupation: inhalant contact.
Theatre or other locations.
Nonspecific irritants: gases, chemicals, soap powders, etc.

Foods and Drugs:
Dislikes and Disagreements.
Symptoms caused by foods and drugs — nasal, bronchial.
Headache, G. I., Skin, G. U., etc.

Climate:
Temperature, humidity, wind, sunlight, altitude.

Physical Agents:
Heat, cold, light.

Psychosomatic Factors.

Associated Manifestations of Allergy (Seasonal or Perennial):
1. Allergic bronchitis.
2. Bronchial asthma.
3. Gastrointestinal allergy.
4. Urogenital allergy.
5. Allergic headache.
6. Skin Allergy: Eczema, urticaria, angioneurotic edema, purpura, contact dermatitis.
7. Allergy of the salivary glands: parotid, submaxillary and sublingual.

SKIN TESTING IN ALLERGY.

Although skin tests are of definite diagnostic importance, their interpretation and significance should be properly evaluated. It is important to determine which reactions are definite or specific and which may be false. All specific positive reactions should be classified as: *1.* nonclinical positives, and *2.* clinical positives. The latter should be reserved for those of proved clinical significance. Some reactions may be considered as potential or future positives. In hay fever, for example, a positive skin reaction to pollen may precede the onset of definite hay fever symptoms. Positive reactions may also persist after clinical symptoms have disappeared.

Skin test extracts may give nonspecific reactions because of the presence of irritating substances or because the extracts are too highly concentrated. Efron suggests that all extracts should be subjected to biologic standardization, by testing

allergic and nonallergic individuals. If a small or insignificant number of reactions appear on the controls, the extract may be considered as suitable. If reactions occur in a large percentage of both groups, however, they should be considered as nonspecific. There is much need, therefore, for standardization of extracts, greater care in the technique and interpretation of the skin tests. The food extracts particularly need greater improvement in stability and standardization. Among different workers, there is great variability in the number of tests performed and the type of allergens used. A standard list of these testing materials should be established. About 30 to 35 pollens and about 150 foods and inhalants are sufficient in most cases.

In the performance of skin tests, both the scratch and the intracutaneous are generally employed.

TECHNIQUE OF DIAGNOSTIC SKIN TESTING.

In planning the treatment for the hay fever or nasal allergy patient, a detailed clinical history and complete skin testing are important. The history discloses the existence of associated manifestations and the skin test is an aid in revealing other sensitivities.

In children under the age of 10 years we employ the scratch test, and in adults both the scratch and the intracutaneous. For all patients we use the scratch test for pollen testing. It is the safer method, the testing materials remain stable and always ready for use at any time of the year. Pollen extracts for intracutaneous testing must be made up into a number of dilutions of different strengths and must be freshly prepared about once a month. In preparations for injection treatment of hay fever, however, we use the various dilutions for making the intracutaneous tests to determine the relative degree of sensitivity.

In the interpretation of skin reactions it is important to take into consideration the variability in the reactivity of individual skins. Varying degrees of dermographia are frequently encountered. The scratch test materials we employ

contain 50 per cent glycerine. The pollens are 1:20, the foods and inhalants, 1:10 dilution. False reactions in sensitive skins may occur from trauma and/or from the glycerine, as shown in Fig. 1.

Figure I

SCRATCH TESTS

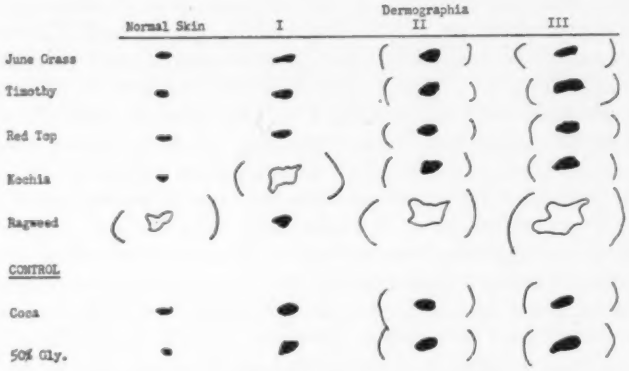
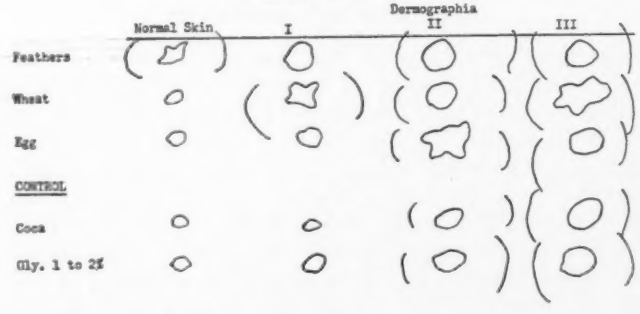


Figure II

INTRACUTANEOUS TESTS



False reactions do not show pseudopods and there is usually an absence of itching, but some degree of erythema. Positive reactions are usually larger on the more sensitive skins. Crossed reactions frequently occur among the various mem-

bers of the grass and ragweed families, and sometimes among foods and inhalants. Skin reactions to pollens in hay fever are very consistent. False reactions must not be interpreted as positive. Occasionally definite positive reactions occur in the absence of a history of hay fever symptoms. These patients should not be treated until it is definitely established that actual hay fever occurs.

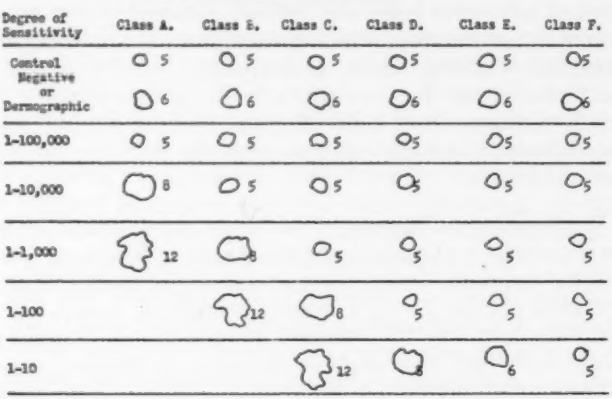
In intracutaneous testing, varying degrees of dermographia are encountered, as in the case of the scratch test. Control tests should be made with the diluent employed, such as saline or Coca solution. Extracts diluted from concentrates containing glycerine may still contain 1 to 2 per cent, so control tests should be made with these solutions. Even in these small concentrations, glycerine may produce false reactions on the very reactive skins. In some skins, however, the Coca solution may react as much as the glycerine. Sometimes it is very difficult to draw the line between a false positive and a true positive reaction. Although the skin tests to pollens are very reliable, those to the foods and inhalants are much less so. The patient may not react to allergens to which he is clinically sensitive or a positive reaction may occur which has no clinical significance.

TITRATION OF DUST SENSITIVITY.

Regardless of the type of plan adopted for dust and other inhalant injection therapy, it is customary to determine the relative degree of skin sensitivity by testing with serial dilutions of the extract. In order to avoid excessive skin reactions which may aggrevate symptoms or even produce constitutional reactions, the higher dilutions should be applied first. It is usually safe to apply, therefore the 100,000, 10,000 and 1,000 dilutions. If a small reaction should occur to the 100,000, then weaker dilutions should be used to the end-point of reaction, which may be the 1:1,000,000. If in a very sensitive patient a wheal of about 12 mm. is noted to the 100,000 dilution, no further tests with the stronger solutions should be made. The end-point of reactions or the weakest solution producing a reaction is more important than the large wheal

produced by a strong solution. From the end-point to a 12 mm. wheal extends through about four dilutions (see Fig. 3).

FIGURE 3. TITRATION OF DUST SENSITIVITY



To determine this range of reaction, it may be necessary to continue this testing to the 1:10 dilution. Bear in mind that the 1:10 may produce a nonspecific or irritating reaction.

Whatever observations are made from titration testing should be correlated with the degree of clinical sensitivity. If the skin reaction is selected as the basis for initial dosage, it is customary to start with a solution 10 to 100 times weaker than the end-point of erythema reaction. There are many instances, however, in which this plan is not advisable. For example, a patient with severe clinical symptoms may show an end-point at a fairly strong solution. In these instances the initial dosage is likely to be too potent. As a matter of fact, marked clinical sensitivity may exist with entirely negative skin reactions.

By the correlation of the skin titration and the clinical history and examination, initial and optimum dosage may be more accurately calculated.

THE DIAGNOSIS AND TREATMENT OF HAY FEVER.

In addition to the management of perennial nasal allergy, the otolaryngologist is also confronted with the problem of the diagnosis of treatment of hay fever. Since about only one-third of hay fever cases are entirely seasonal, there remains the other two-thirds in which perennial nasal and other manifestations of allergy occur. It is apparent, therefore, that the treatment of hay fever involves sensitivities other than pollens in the majority of cases. For the most satisfactory results in treatment, therefore, other sensitivities must be recognized and controlled.

The rhinologic diagnosis of hay fever is not difficult because the symptoms are classical, the nasal mucosa is pale and boggy and the secretions contain large numbers of eosinophiles, the symptoms appear during a specific pollinating season and the final diagnosis may be confirmed by skin tests. Atmospheric pollen counts and field surveys should be performed in order to know which pollens are involved and their relative concentration in the air.

In most areas of the United States, there are three distinct pollinating seasons; namely, the tree, the grass, and the weed. Any of the textbooks on general allergy or hay fever give complete reports on the hay fever problem as it concerns the particular area in which you are located.

Hay fever most commonly affects the patient early in life. As a matter of fact, in about 50 per cent of the cases, the onset is before the age of puberty. It is important, therefore, that hay fever be recognized and properly treated in childhood. Early management of hay fever may prevent the development of other sensitives such as foods and inhalants, as well as the precipitation of other manifestations of allergy. It is apparent that most hay fever cases become complicated because treatment was not started early and adequately instituted.

Hay fever may be acquired by massive exposure, especially in those who are already allergic. Cross-country automobile

travel and the entrance into hay fever areas from non-hay fever areas should be avoided. This particularly is true of the ragweed pollen exposure.

In all patients, complete skin testing should be performed, as a large percentage will show food and inhalant reactions. Food sensitivity is common in hay fever and represents a most important factor in treatment. Adequate pollen therapy may be a complete failure because food and inhalant factors are not controlled. In a group of 75 cases recently analyzed, we found an incidence of these extra-pollen reactions of 80 per cent. Among pure seasonal hay fever patients, these food and inhalant sensitives may not cause symptoms at other times of the year. In those who have perennial symptoms, of course, it is evident that they are a constant factor.

Some hay fever patients have a continuation of symptoms for one to three months after the ragweed season, because the sensitivity to extra-pollen allergens does not subside or is not controlled. Atmospheric molds are most important as a cause of symptoms extending from the end of the pollinating season until the first killing frost. Severe asthma not infrequently also develops during this period. Foods and inhalants are frequently the cause of this complication.

All hay fever patients must practice a certain degree of prophylaxis by avoiding common inhalants such as house dust, feathers, orris, animal danders, smoke and irritating vapors. No alcoholic liquors should be permitted. Smoking should be prohibited or highly restricted. Avoidance of those factors which involve greater exposure to pollen should likewise be practiced.

POLLEN THERAPY.

In the treatment of hay fever by the administration of pollen extracts, three different methods may be employed; namely, the preseasonal, the perennial and the occasional.

THE PRESEASONAL AND PERENNIAL METHODS.

The former is the one mostly employed. It consists of the administration of a series of injections, starting with a small

dosage and gradually increasing over a period of about three or four months to the largest one tolerated by the patient. The initial dose is usually one unit and the maximum about 25,000 to 50,000 units. Initial and maximum doses are usually based upon the degree of sensitivity as determined by the scratch, intracutaneous or conjunctival tests. Some allergists employ a method of giving less dosage in a shorter period of time. After the first season the perennial method may be used, in which about one-half the maximum dosage is administered twice monthly and finally increased again before the next season begins. With the maximum or high dosage method, the question still remains as to whether protection or relief is obtained as the result of the production of a blocking antibody or whether the patient reaches a "state of refractoriness."

Although this method is the one most commonly employed today, it certainly is not the one of choice for the novice. Local and/or general constitutional reactions may occur, sometimes to an alarming degree. Dosages must always be carefully calculated and administered. One must be thoroughly familiar with the management of reactions when they do occur.

Perennial and preseasonal treatments by the oral method have also been employed. The same plan of administration is used, starting with a small and increasing to a maximum dose. Top doses as high as 250,000 units have been given. On the whole, practically all reports on this method have been discouraging.

THE CO-SEASONAL METHOD.

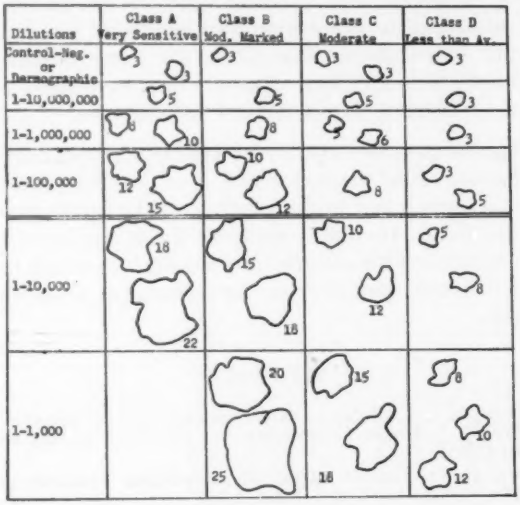
When the patient reports for treatment at the onset or during the pollen season, this is the only method that can be employed. It consists of the injection or the oral administration of small doses of pollen extract.

For the past 10 years we have employed this method as the one of choice. If properly planned, the method is safe and free from all dangerous reactions. It requires fewer treat-

ments, is more economical for the patient and the results are very satisfactory.

Injection treatments are given subcutaneously or intracutaneously. Treatments are administered every one to three days. There is a certain small optimum dosage which gives satisfactory relief for the above periods of time. Uncomplicated cases are much more easily and satisfactorily controlled than those with complicating sensitivities. The dosages employed in treatment are arbitrarily based upon the relative

Fig. 4. TITRATION OF POLLEN SENSITIVITY



degree of skin sensitivity as determined by the titration method illustrated in Fig. 4. The test is usually performed just before the onset of the season, but may also be done during the season.

A control test with the diluent employed should be made in order to determine the relative reactivity of the skin. In all tests, 0.01 to 0.02 cc. is injected, making an initial wheal of

about 3 to 4 mm. First, the pollen dilutions of 10,000,000, 1,000,000 and 100,000 are tested, and recorded after 20 to 30 minutes. If a wheal 15 to 18 mm. is noted with the 100,000 dilution, it is not necessary to apply the 10,000 dilution. If the 100,000 dilution gives a 10 to 12 mm. wheal, the 10,000 solution may be added. We have found by clinical experience that a wheal about 19 to 20 mm. in diameter, created with 0.03 to 0.05 of a given dilution produces the best effect. If, for example, 0.01 to 0.02 of the 100,000 produces a 15 mm. wheal, 0.03 to 0.05 will produce a wheal 18 to 20 mm. in diameter. Most patients are treated with the 100,000 and the 10,000 solutions. In only a small percentage of cases is the 1,000 solution necessary. The intervals between treatments are regulated according to the degree and length of period of relief. In giving subcutaneous injections, the same dosage may be used in a dilution 10 times weaker. That is, instead of injecting 0.03 of 100,000, inject 0.30 of 1,000,000.

During the past two years we have been experimenting with a small dosage oral method which is still under clinical investigation, so only a few preliminary remarks can be made about it at this time. In some cases we have employed the oral method entirely with satisfactory results. In other instances, we used it in conjunction with intracutaneous or subcutaneous injections.

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PART III.

ALLERGY IN OTOLARYNGOLOGY.

ALLERGIC MANAGEMENT — TREATMENT.*

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ALLERGIC MANAGEMENT.

Treatment: Successful management of allergy of the eye, ear, nose and throat depends on an accurate diagnosis and treatment directed along general and immunological lines.

It has already been emphasized that a careful allergic history, the correct evaluation of symptoms and the recognition of an increased number of eosinophiles in the nasal secretion as determined by cytological examinations are the most important factors in making a positive and accurate diagnosis of nasal allergy. Further information can sometimes be obtained from the skin tests and, when positive, the skin tests should be closely correlated with the clinical history.

It must be remembered, however, that negative skin tests do not necessarily rule out the presence of respiratory allergy in those patients with perennial symptoms. Excellent results frequently follow hyposensitization to the inhalants, even though the skin tests to those same inhalants are negative. The following is given as a possible explanation for this inconsistency of the skin tests in many types of allergy, and particularly in nasal allergy.

Allergy is a general disease with local symptoms. It may affect any or all tissues. On the other hand, it may be very selective in tissues affected. For instance, the nasal mucosa may be very sensitive to a specific allergen, and yet the skin may be entirely insensitive to the same allergen even in concontrated amounts. Likewise, gastrointestinal allergies may

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give no secondary symptoms in either the skin or the respiratory tract, but may give marked symptoms in the vascular system, causing headaches, mental haziness and vertigo.

This specificity may even develop to the point that cells of the same organ or tissue may become sensitized while other directly adjacent identical cells may fail to become sensitized, as illustrated by the localized swelling occurring in angioneurotic edema.

Rawlins[1] believes that a positive skin test simply means that there is a sensitizing antibody or reagin in the skin itself, and that a negative test means there is *no* sensitizing reagin in the skin. A negative skin reaction, however, does not preclude the presence of sensitizing reagin in the nasal mucous membrane capable of producing nasal allergic symptoms.

The symptoms of perennial nasal allergy vary greatly in degree and severity and may range from the slight distress of nasal stuffiness, small increase in nasal discharge, and mild chronic cough through all grades of severity, up to and including typical asthma and asthmatic bronchitis. The less severe symptoms may be mistaken for frequent head colds, cigarette cough, sinusitis or chronic catarrh. This symptom complex has rightfully been called "the most commonly overlooked and the most mismanaged of all symptom complexes."

The treatment of each patient must be on an individual basis and, since the symptoms are so varied, it is well to follow a definite plan of treatment, beginning with the simplest method which gives promise of relief and resorting to more complicated procedures only after the simpler methods have failed. These procedures may be summarized as follows: *a.* Measures to improve the general health of the patient. *b.* Elimination of the offending allergen. *c.* Use of certain drugs. *d.* Conservative surgery. *e.* Hyposensitization.

General Measures: The two most important factors in the production of an allergic reaction are inherited or biological predisposition, and contact between the sensitive individual or the potentially sensitive individual and the allergen to which he is or may become sensitive.

There are, however, many other predisposing factors which can disrupt the sympathetic-parasympathetic balance and initiate attacks of nasal allergy (so-called trigger mechanisms). Prominent among these are: emotional upsets, mental conflicts, psychosomatic influences, endocrine dyscrasias (such as adolescence, menopause, rhythm and abnormal glandular activities). All of these predisposing factors must be investigated and proper treatment instituted when such treatment is indicated.

The importance of nutritional deficiencies as a prominent etiological factor in nasal and sinus pathology has long been recognized by Selfridge,[2] Shurly[3] and Jarvis,[4] and more recently stressed by Jones,[5] Lewis, Hunnicutt and others. Roberts,[6] in an exceedingly comprehensive paper, calls attention to the great importance of correcting these deficiencies in the treatment of nonsuppurative sinusitis.

Our own experience has shown that a careful diet analysis frequently reveals unsuspected vitamin and mineral deficiencies in many allergic individuals. Correction of these deficiencies not only improves the general health of the patient but also aids materially in relief of the allergic symptoms and shortens the time required to bring the allergy under control.

Satisfactory analyses are best obtained by enlisting the services of a trained nutritionist. A detailed list of all foods and the amounts ingested by the patient over a period of one week gives the data necessary for the analysis. The nutritionist's report notes all deficiencies, how they can be corrected dietetically, and what amino acids, vitamins and minerals must be added to insure a completely balanced diet. Dietary analyses have become routine procedures in all of our allergic examinations.

Food allergies are frequent complicating factors and give sudden but usually temporary symptoms, rarely causing hypertrophic changes in the nasal and sinal mucous membranes. Complete elimination of all offending foods from the diet is the only way of preventing such allergic reactions. If the offending foods cannot be readily identified from the patient's

history, one of the elimination diets as described by Rowe[7] may be useful in making this identification.

Local treatments in uncomplicated nasal allergy are to be condemned. They are of little or no value and often aggravate the allergic symptoms and prolong the necessity for treatment.

Elimination of Offending Allergens: The elimination of the causative allergen is usually not possible; however, the following regime has proved of value in helping to control allergic sypmtoms: *a.* Stop all nose drops, inhalers, nasal jellies, sprays and irrigations. *b.* Dustproof covers for pillows and mattresses. *c.* Elimination of contact with animals and birds. *d.* Dustproof sleeping quarters as much as possible, remove woolen rugs and ozite from sleeping quarters and wipe woodwork thoroughly with an oil cloth. It has been noted that if the patient can be comparatively free from dust during his sleeping hours, symptoms are often markedly relieved. *e.* Avoid contact with insecticides and sprays. *f.* Use only unscented soaps and nonallergic cosmetics. *g.* Avoid smoking or coming in contact with smokers. *h.* Avoid woolen blankets, clothing and rugs. *i.* Remove woolly and fuzzy playthings from children's environment. *j.* Avoid those foods which have been found to be most frequent offenders causing hyposensitiveness, such as: nuts, beans, chocolate, milk, eggs and fish, prepared dressings containing cottonseed oil, tomatoes and onions. Take only a limited amount of orange juice, sugar and refined wheat. *k.* Change of occupation or residence is sometimes necessary. Whenever it is impossible to avoid or eliminate some inhalants, it is necessary to institute injection therapy.

THE USE OF CERTAIN DRUGS.

Drugs are usually given to control symptoms of allergy and not with the idea that they have any curative effect on the underlying causes of allergy. They should be used only as palliative measures and as soon as allergic control has been obtained should be discontinued.

Drugs should not be given in large enough quantities to mask the symptoms and to make the evaluation of hyposensitization treatment impossible.

There are three groups of drugs which are useful in the treatment of allergic symptoms:

1. Sympathetic stimulators or adrenalin-like drugs; *e.g.*, adrenalin and ephedrine.
2. Parasympathetic or acetylcholine inhibitors; *e.g.*, atropine group.
3. Antihistamine group; *e.g.*, benadryl and pyribenzamine and similar preparations.

The antihistamine drugs are useful in those cases where the histamine factor is prominent, particularly in angioneurotic edema, urticaria and acute attacks of hay fever. They are of little value, however, in the ordinary low grade cases of perennial nasal allergy where the histamine is a minor factor.

The following prescription has been found to be useful in controlling the symptoms of acute exacerbations: Ephedrine gr. $\frac{3}{8}$ to $\frac{1}{4}$, phenobarbital gr. $\frac{1}{4}$ to $\frac{3}{8}$, atropine gr. 1/400. The advantage of this prescription is that the ephedrine and phenobarbital ratio can be set to suit the nervous as well as the phlegmatic patient.

Benadryl and pyribenzamine, as has been stated, are of value in some cases. The following prescription may be valuable: Benadryl 20 mg., ephedrine sulfate gr. $\frac{5}{8}$, nembutal gr. $\frac{1}{2}$, aminophylline gr. 3.

The same dose of pyribenzamine may be substituted for the benadryl in this prescription. Arlcaps, tedrol, novaline and amodrine have been found to be of value. Ephedrol, the elixir of benadryl and the elixir of pyribenzamine are all pleasant preparations and are readily taken by children.

Hansel recommends the following combination as being particularly effective for relief of asthma in children: K I gr. 48 to 72, theophylline gr. 18 to 24, elixir benadryl q s oz. lll. One teaspoonful every three to four hours as needed.

HYPOSENSITIZATION.

A great majority of all nasal allergies are caused by inhalants. If those specific allergens which cause hay fever are excluded, by far the most common inhalant causing nasal allergy is house dust. House dust contains:

a. Many known allergens to which the patient may be allergic, and some specific allergen, the nature of which is unknown.

b. Chief constituents are: cotton, flax, jute, wool, silk, animal hair, kapok, orris root, pyrethrum, tobacco, mold and fungi.

Hansel states, "For many years we employed autogenous extracts, but found that they varied considerably in potency and effectiveness. On the whole, a good composite stock dust is more satisfactory, although there are occasionally instances in which the autogenous extract is better. Specific occupational dust extracts, however, may be absolutely necessary in special cases. Extracts of specific animal danders, orris, tobacco smoke extract, newsprint or similar substances may be prepared separately and added to the house dust extract at the time of injection. Specific mold extracts or feed mill molds may likewise be added. In many areas of the country, atmospheric molds are just as important as the pollens. For many years we have incorporated an extract of these molds into our stock dust mixture in the ration of 10 per cent.

"When the patient refuses to eliminate the dog or cat from the household, the injections of these extracts may give adequate protection against these danders. In using the high dilution or small dosage plan of treatment, there is no objection to adding these extracts empirically."

With the institution of injection therapy, the initial dosage depends upon the plan of administration to be employed. Two methods are generally followed; namely, the large dosage build-up and the small dosage or high dilution optimum maintenance dosage.

In the first method, initial dose is estimated at a point just below that which gives the smallest skin reaction. This is usually the 1:1,000 or the 1:100 dilution. The concentration of the extract is gradually increased at five- to seven-day intervals to the maximum, which not infrequently is the concentrated.

By gradually increasing the dosage to the highest point tolerated by the patient, relief is apparently the result of creating a state of refractoriness.

Previous to 1936, Hansel[8,9] employed the large dosage methods, but following some observations on the small dosage treatment of hay fever, he began the application of this plan to dust therapy. Initial doses were reduced to 1:10,000 and 1:100,000, later to 1:1,000,000. In many instances he noted that relief of symptoms occurred after the initial injection, but that effectiveness was lost when the dose was increased. This was the beginning of the plan of optimum maintenance dosage. That is, when satisfactory results were obtained, the dosage was not increased.

Later it was observed that dilutions weaker than 1:1,000,000 were necessary to produce relief of symptoms, so gradually, by repeated observations extending over a period of 10 years, the dilutions for initial and effective dosage were reduced to 1:10,000,000 and finally to as low as 1:10,000,000,000.

When the 1:1,000,000 and 1:10,000,000 dilutions were reached, it seemed utterly fantastic that such a small amount of extract could be effective. It became even more fantastic when 1:10,000,000,000 was reached; however, with these dilutions relief was obtained in many patients who had been refractive to treatment when stronger solutions of the antigen were used. Although no immunological proof has been established for the rationale of this type of therapy, clinical results have been so universally good that they speak for themselves.

The method, furthermore appears quite logical when one stops to realize that clinical symptoms are precipitated by

dusts and pollens upon the inhalation of extremely small amounts of allergen in terms of amount of extract. Severe hay fever symptoms, for example, may be initiated by the inhalation of 1/100 of a unit of pollen in terms of the amount of extract at the peak of the ragweed season, the patient does not breathe more than two to five units daily and only a fraction of the pollen extract probably reaches the blood stream.

Small dosage therapy, therefore, theoretically at least, should be effective in neutralizing the extract contained or absorbed and in building up some protective immunity. No satisfactory explanation of this phenomenon had been described before Loveless[10] showed that there is a two-antibody mechanism involved.

GENERAL THERAPEUTIC SUGGESTIONS.

Following is a routine method of hyposensitization to the perennial inhalants which has proved effective in our practice:

1. Establishing proper size of dose is the most important factor in obtaining results.
2. Patients treated according to symptoms, not according to skin tests.
3. Starting dose according to symptoms; the more severe the symptoms the smaller the dose.
4. Food sensitive, asthmatic and hay fever patients are usually more sensitive and should be started with an initial dose smaller than average.
5. Dose should be smaller during the hay fever season and during acute episodes.
6. Maintain dose at effective point. Do not increase when relief is satisfactory.
7. When patient remains symptom-free for three 21-day periods, stop treatment.

SPECIFIC TREATMENT.

1. Antigen used is house dust to which mill molds, fungi and smuts have been added (Wittich's antigen) in proportion

of nine parts dust to one part Wittich. (Other inhalants such as tobacco smoke, paper, animal danders, etc., which may be suspected from history are empirically added.)

2. Dilutions of 1:10,000,000,000, 1:1,000,000,000, 1:100,000,000 and 1:10,000,000 made with Coca solution are used. I repeat, these dilutions are fantastically small, but experience has shown them to be effective.

3. Starting dose is usually from 0.1 cc. of 1:10,000,000,000 to 0.1 cc. of 1:1,000,000,000 for those patients with very severe symptoms, for very small children and for asthmatic patients. A starting dose of 0.1 cc. of 1:100,000,000 for those with severe symptoms is used, and 0.1 cc. of 1:10,000,000 for those with milder symptoms.

4. Doses are given twice weekly to start.

5. Doses are increased 0.1 cc. at each dose (after the first dose, 0.1 cc. is given intradermally and the balance subcutaneously), until symptoms are relieved or until 0.5 cc. is given.

6. If improvement is noted before 0.5 cc. is reached, the dose is held to that point and the interval between doses is increased, first to once per week, then to once every two weeks, and finally to once every three weeks. When the patient can go symptom-free for three 21-day periods, the treatment is stopped.

7. If symptoms are not relieved on reaching 0.5 cc., 0.1 cc. of the next lower dilution is given and the routine continued. If this dosage causes a flare-up in symptoms, the tendency should be toward lowering the dose. Frequently dilutions of 1:1,000,000,000 or even 1:10,000,000,000 have given relief when stronger dilutions have failed.

8. A dose which aggravates, *i.e.*, increases the nasal stuffiness, increases nasal secretion, or increases the perennial type of cough, is too large and the dose should be dropped back by 0.1 cc.

9. A dose which gives improvement in symptoms but fails to carry the patient symptom-free to the time of the

next injection is too small, and should be increased by 0.1 cc.

10. Once effective dose has been determined, maintain dose at that point. Do not increase when relief is satisfactory.

Hansel's method for beginning doses is outlined in Plate I.

PLATE I. DUST AND MOLD THERAPY (HANSEL).

1:100,000 Very mild nasal allergy. Stuffy type, postnasal drip. No significant sneezing or discharge.	1:1,000,000 Moderate. Mild stuffy, postnasal discharge. Occasional sneezing.
1:10,000,000 Moderate. Marked obstruction, sneezing and discharge. Symptoms may be intermittent.	1:100,000,000 Marked sneezing, obstruction and discharge, itching. Continuous symptoms, marked nasal changes.
1:1,000,000,000 Very severe, same as previous group. Very marked edema. Polyps. Very edematous.	1:10,000,000,000 Very marked asthma. Small children with nasal allergy or asthma.

REASONS FOR OCCASIONAL FLARE-UPS.

1. Too long between injections before allergy is completely controlled.

2. Contact with an overpowering dose of antigen.

3. Sudden changes in temperature and humidity.

4. Acute infections.

5. Psychological upheavals.

6. Fatigue — both mental and physical.

7. Indiscretions of diet and overindulgence, alcohol and smoking.

RESULTS.

1. A high percentage of allergic patients become symptom-free.

2. Symptom-free period varies from months to years.

3. If symptoms return, three to five injections are usually all that are necessary to again relieve symptoms.

4. There are no dangerous local or general symptoms as occasionally seen when larger doses of antigen are given.

(This is important; the patient is hyposensitized *without danger of local or constitutional reactions.*)

5. Subjective improvement is frequently manifest after a very few injections, often after the first injection.

6. Objective improvement in the appearance of nasal mucosa is frequently observed after four or five injections.

7. A high proportion of chronically infected sinuses clear up spontaneously as the underlying allergy is brought under control.

SUMMARY.

1. Satisfactory treatment of nasal allergy depends on the general therapeutic measures. the elimination of the causative allergen, the use of ephedrine and similarly acting drugs, surgery only after hyposensitization has been obtained, and finally hyposensitization.

2. Most chronic nasal allergy is caused by inhalants.

3. If those specific allergens causing hay fever are eliminated, the most common allergen causing nasal symptoms is house dust.

4. Important points in hyposensitization treatment of chronic nasal allergy:
   a. Small doses of very dilute antigen.
   b. Build up dose only to point at which relief is obtained, then lengthen time between injections; if symptoms are aggravated, drop the dose.
   c. When patient is symptom-free, stop treatment.

5. Results:
   a. A very high percentage of patients treated have become symptom-free for varying lengths of time, months to years.
   b. No severe local or constitutional symptoms have been observed except in a few patients with an asthmatic background, and these successfully treated by lowering the initial dose of antigen.

c. Improvement of symptoms is often noted after the first injection, and improvement in the appearance of nasal mucosa is frequently observed after the fourth or fifth injection.

d. Many points in method of procedure have abundant clinical basis, but no scientific basis.

e. Many unknown factors need clarification.

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SURGICAL DISEASES OF THE ESOPHAGUS.*†

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The three most important esophageal lesions from the otolaryngologist's point of view are carcinoma, benign stricture due usually to the ingestion of corrosive substances, and achalasia. Carcinoma of the esophagus is one of the most formidable of the esophageal diseases because of its devastating effect on its victims, resulting in death from starvation within six to eight months if untreated. Esophageal stricture, too, is an extremely uncomfortable condition since the patient is unable to swallow food, and in some cases there is an accumulation of saliva in the mouth, with an overflow into the trachea and bronchi, inevitably resulting in recurring pneumonitis and bronchiectasis if untreated. Achalasia, which is characterized by dilatation and hypertrophy of the esophagus with obstruction of the cardia, though not a common disease, occurs with sufficient frequency to merit serious consideration. It might be expedient to consider malignant lesions and benign strictures of the esophagus together, since their surgical treatment is essentially the same.

BENIGN AND MALIGNANT ESOPHAGEAL LESIONS.

The incidence of carcinoma of the esophagus appears to be increasing and, though formerly considered rare, it now ranks as the ninth most frequent malignant tumor occurring in the white male.[1] Benign stricture of the esophagus, on the other hand, is encountered less often now than formerly, probably because of educational control measures as well as the decreasing employment of corrosive substances as household agents.

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Carcinoma of the esophagus is essentially a geriatric disease, whereas benign strictures are encountered primarily in young children following the ingestion of caustic substances. Of 200 patients with carcinoma of the esophagus admitted to Charity Hospital of Louisiana at New Orleans, 70 per cent were between the ages of 50 and 70 years, although the ages ranged from 31 to 84 years. It appears that there is a greater occurrence of carcinoma of the esophagus in older persons than there is of any other type of cancer.

Carcinoma of the esophagus seems to occur with about equal frequency in Negroes and in white people. Fifty-five per cent of the series from Charity Hospital were Negroes, although the incidence of total admissions to this hospital is the same for both races. The high incidence in the Chinese has been attributed to the ingestion of extremely hot tea.

The exact etiology of esophageal malignancies is unknown, although it is generally agreed that chronic irritation is of significance in the production of malignancy. Undoubtedly the presence of gastric cell rests in the lower end of the esophagus is a factor in the development of malignancies in this region, since gastric mucosa is particularly susceptible to malignant change. Benign strictures, with the exception of an occasional congenital case and inflammatory conditions, are due to the ingestion of caustic substances, particularly lye.

The majority of cases of carcinoma of the esophagus occur in the thoracic area, although the lesion may be situated in any portion of the cervical or thoracic esophagus. It is fortunate that approximately 80 per cent of the cases are located in the thoracic and abdominal portions of the esophagus, since these areas are surgically more accessible than is the cervical portion.

Of the two recognized types of carcinoma of the esophagus, the squamous cell type is much commoner. Although it arises principally from the epithelial lining of the esophagus proper, it has been found in any portion of the canal. It is usually ulcerative and shows a tendency for proliferative growth near its borders and submucosal extension beyond its

apparent peripheral limits. This latter tendency makes wide resection imperative to insure removal of the entire lesion. The other type is the adenocarcinoma, which is usually located in the lower segment of the esophagus. Arising most often in upward extension of gastric mucosa in the region of the esopahgus, it may at times originate in islands of misplaced or aberrant gastric mucosa.

Esophageal cancer is associated with a high degree of malignancy primarily because of its rapid invasive tendencies, its propinquity to vital structures and to a lesser extent because of its obstructive nature. The last results in early starvation with rapidly progressive deterioration. If the lower or mid-esophageal portions are involved, lymph node metastasis is usually directed caudally to the hilar region, the somewhat lower periesophageal region, the cardia, the gastrohepatic ligament and around the left gastric artery. It is not known how frequently regional lymph node metastasis occurs, but a significant number of patients do have extensive involvement.

The early clinical manifestations of carcinoma of the esophagus are often so indefinite as to be ignored. The initial symptoms, which are insidious and intermittent, consist of a vague sensation of oppression or fullness in the thoracic or substernal areas, epigastric distress, heartburn and increased salivation, usually associated with the ingestion of food and frequently disappearing after the meal. Following several months of these vague complaints, symptoms become progressively more apparent and well defined. Dysphagia, which is often erroneously considered the earliest symptom, is first manifested as a sensation of food sticking in the throat. In the beginning, regurgitation occurs at infrequent intervals but gradually these intervals become shorter and shorter, until finally regurgitation follows each meal. As soon as the patient discovers that relief can be obtained by regurgitation, he begins to induce it voluntarily. As the disease progresses, the dysphagia becomes so acute as to cause actual starvation. The patient finally loses his appetite and this results in progressive and rapid loss of weight and strength, inanition, dehydration, anemia and cachexia. Esophageal strictures result primarily

in dysphagia; however, if the stricture is impermeable, in addition to difficulty in swallowing, there is increased salivation which frequently produces an overflow into the trachea and bronchi. Bronchiectasis in such cases is an inevitable consequence.

The diagnosis of esophageal strictures is not difficult since there is usually a history of ingestion of a corrosive substance. Unfortunately, the diagnosis of carcinoma of the esophagus is made all too often after the lesion has become so far advanced as to make curative therapy impossible. Failure to make the diagnosis early is due to the insidious onset and vague early manifestations of the disease. The average duration of symptoms in our experience has been between four and six months and an even longer period has been reported by some observers. An early diagnosis can be made only by the constant awareness that vague epigastric and thoracic distress may be produced by esophageal carcinoma.

If the disease is suspected, the diagnosis may be established or eliminated by esophagography and esophagoscopy. The former procedure, that is, the fluoroscopic and roentgenologic examination of the esophagus by means of a barium meal, can usually establish the diagnosis. In suspected cases, esophagoscopy should also be employed since it permits complete visualization of the entire esophagus and biopsy of suspicious regions.

The only curative treatment for esophageal malignancies is surgical extirpation of the lesion. Proper early treatment of benign strictures may, in a number of cases, prevent the development of subsequent cicatricial obstruction; however, despite proper early treatment, conservative management may eventually become ineffective because of progression of the cicatricial obstruction. The significance of a safe surgical method of treatment, therefore, becomes obvious.

It has been only within the last few years that a safe and satisfactory surgical method of treatment of both benign and malignant obstructive lesions of the esophagus has been developed. By 1941 there had been developed a satisfactory sur-

gical procedure for lesions located in the lower third of the esophagus and cardia. This consisted essentially of extirpation of the involved area, with restoration of the continuity of the alimentary tract by intrathoracic esophagogastrostomy; however, lesions in the remaining two-thirds of the esophagus were still being treated by procedures based on the principles of the old Torek operation[2] with subsequent multistaged antethoracic esophagoplasties for restoration of continuity of the alimentary tract. Although there were isolated reports of cure by this procedure, the prognosis in high gastric and esophageal carcinomas was generally hopeless. In 1944, Garlock[3] and Sweet[4] demonstrated that the stomach could be adequately mobilized to bring it to the highest levels of the chest with immediate restoration of function. This completed the development of the surgical treatment so that it is now possible to treat obstructive lesions involving practically all levels of the esophagus.

Successful management of patients with benign or malignant esophageal lesions depends upon several factors, particularly careful attention to preoperative preparation and postoperative care and certain technical aspects of the operation. Because of esophageal obstruction resulting in dysphagia, these patients usually manifest pronounced degrees of nutritional deficiencies and secondary anemia; furthermore, since many of the patients with malignancy are elderly, the factor of diminished cardiovascular reserve should be considered.

Restorative measures include the institution of a properly planned liquid diet with a high caloric and vitamin content, supplemented by the parenteral administration of fluids, electrolytes, vitamins and whole blood.[5] Although preliminary gastrostomy is usually essential in cases of benign stricture in order to maintain nutrition, in our experience, it has been found usually unnecessary and occasionally disadvantageous in cases of carcinoma.[5] The transfusion of large amounts of whole blood, often as much as 3,000 cc., during preoperative preparation is important to bring the circulating blood volume to normal levels.[6]

The systemic administration of penicillin will effectively control infection. We usually begin penicillin therapy one or two days before operation and continue it postoperatively for four or five days or until the temperature has been normal for two days.

The technical aspects for both high and low lesions of the esophagus are essentially the same. Only a brief consideration of the essential points of the technique will be discussed here since they have been described in detail elsewhere.[7] A thoracic or thoracicoabdominal approach is employed, depending upon the site of the lesion. Low lying malignant lesions near the cardia are particularly accessible through a thoracicoabdominal approach. If the lesion involves the upper end of the stomach and there is doubt concerning resectability, performance of the abdominal portion of the approach first permits exploration and determination of resectability. If the lesion is resectable, the incision may be extended across the costal arch into the left side of the chest. On the other hand, if the lesion is found to be too extensive to warrant attempted resection, gastrostomy can be performed through the same incision. Lesions located higher up are, of course, more difficult to approach, but entrance into the left pleural cavity through the bed of the subperiosteally resected sixth or seventh ribs with division paravertebrally of the ribs above and below the one resected will provide adequate exposure.

The next step is retraction of the lung forward with exposure of the esophagus by opening the mediastinal pleura from the aortic arch to the hiatus and mobilizing the esophagus from its bed by careful sharp and blunt dissection, care being taken to ligate the esophageal vessels. In the more highly situated lesions requiring mobilization of the esophagus from behind the aortic arch, dissection is often difficult and tedious because of the intimate adherence of the esophagus to its surrounding structures. Above the aortic arch the esophagus is exposed through an opening in the mediastinal pleura behind the left subclavian artery.

The third step is mobilization of the stomach, which consists primarily in division of the gastrolienal, gastrocolic and

gastrohepatic ligaments and their vessels, care being taken to preserve the vascular arches along the greater and lesser curvatures. This is followed by division of the left gastric artery close to its origin and, in malignant cases, complete removal of the lymph nodes in this region. This should be done with the utmost gentleness and care to avoid injury of the intramural vascular integrity of the stomach since the entire blood supply to the stomach is now derived only from the right gastric and gastroepiploic arteries. In some cases mobilization of the pylorus and first portion of the duodenum by incision of the periotoneal covering to the right of the duodenum may be desirable in order to permit the cardia of the stomach to be brought up to the apex of the chest without tension.

Following complete mobilization of the stomach, it is divided between clamps just below the esophagogastric junction; the gastric stump is closed with inverting sutures and the proximal stump is covered with a rubber tampon. If the carcinoma is located at or near the cardia, the stomach should be resected well below the area of involvement, with generous resection of the lesser curvature, frequently as far distally as the pylorus, producing a long gastric tube of the remainder of the stomach.

Esophagogastric anastomosis is the final step. In lesions of the lower portion of the esophagus there is usually a sufficient amount of normal esophagus to permit anastomosis below the aortic arch; however, in the lesions located higher, the anastomosis must be performed above the aortic arch. This is accomplished by bringing the esophagus, first, out from under the aortic arch and through the opening in the mediastinal pleura lateral to the left subclavian artery. Even if anastomosis can be done immediately below the aortic arch, it is probably more prudent to bring the esophagus out from under the arch and perform anastomosis to the left of the arch, because it is easier and may be done with less angulation and tension on the suture line because of the diminished blood supply in this region. In malignant cases, furthermore, resection of the esophagus should be well above the lesion because

of the tendency for submucosal extension of the lesion. In this connection immediate histologic examination of the upper end of the esophagus should be done following resection, so that the operator will know definitely at the time of operation whether resection has been accomplished above the tumor.

A two-layer row of interrupted sutures of quilting cotton is used for anastomosis. The opening between the esophagus and stomach is made in an L-shaped manner, paralleling the row of sutures. The primary purpose of this is to provide a larger stoma than would be obtained if only the transverse diameter of the esophagus were used. Although it may not be necessary if there is dilatation of the esophagus, it provides a means of securing a large stoma in cases in which the lumen is not large and insures against the development of subsequent narrowing.

Following anastomosis, the stomach should be attached to the parietal pleura posteriorly with a row of interrupted sutures along the greater curvature and the opening in the diaphragm closed around the stomach. A catheter is inserted through one of the lower intercostal spaces into the pleural cavity for drainage. The lung is then well expanded and the wound is closed in layers.

Although it may not be essential to administer oxygen for the first 12 to 24 hours immediately following operation, this procedure appears to be beneficial. During the first several postoperative days, parenteral fluids, electrolytes and blood are administered as required. During this early postoperative period prophylactic measures should be directed against the occurence of pulmonary complications, such as atelectasis and pneumonitis. Although some surgeons prohibit drinking early in order to provide immobilization at the site of anastomosis, we have observed no undesirable effects from this, so we have permitted the patient to drink fluids, usually tap water, as soon as he has recovered from the anesthetic. Suction attached to an intranasal gastric tube will keep the stomach deflated. This tube can usually be removed by the third or fourth postoperative day, when intestinal peristalsis has returned and

small feedings can be started. Early ambulation is encouraged and most patients are out of bed by the fourth or fifth day.

The mortality rate in these cases is still high. There are several reasons for this. Most of the patients are extremely debilitated when they are operated upon, and in patients with malignant tumors the lesion is frequently not diagnosed until it is so far advanced that cure is impossible. In our series of 200 cases exploration was considered justifiable in only 58, or 29 per cent, and only 16 per cent of the entire series were resectable; however, with refinements in technique and improvements in preoperative and postoperative management, the mortality rate has been reduced from about 70 per cent, before 1945, to around 31 per cent, in 1945, and it is even lower now, probably around 20 per cent. Of 101 patients in whom there has been a follow-up, resection was done in 51 per cent, and 51 per cent were alive at the end of one year, 22 per cent were alive at the end of two years and 10 per cent at the end of five years. Thus it may be seen that radical surgical measures offer some hope to the patient with an esophageal malignancy.

ACHALASIA.

The surgical significance of achalasia has never been fully appreciated. This is probably due to the fact that the condition is not a particularly common one (it comprises about 17 per cent[8] of esophageal lesions) and the majority of patients can be treated conservatively; however, it has been estimated that about one-fourth of the patients treated conservatively will not be completely relieved and will require surgical treatment at a later date.

There has been an erroneous impression that surgical therapy of achalasia entails a considerably greater risk than conservative therapy. Actually, the mortality rate of the latter is only slightly greater than the former. Moersch[9] reported a mortality rate of 2.8 per cent in 804 patients with achalasia treated conservatively, whereas in 239 collected cases in which

cardioplasty and esophagogastrostomy were performed, the mortality rate was 4.2 per cent.[10]

The number of surgical procedures advocated for the correction of achalasia reflects the perplexed state of our knowledge of the etiology and pathogenesis of this condition. These procedures were previously classified into operations directed toward the: *1.* dilated esophagus, *2.* cardia, *3.* diaphragm and *4.* nerve supply.[10] Procedures directed toward the dilated esophagus are obviously illogical and are merely of historical interest. A more rational approach would be one directed toward the cardia, since the food ingested meets obstruction at this point. Dilatation of the cardia with an instrument resembling a glove stretcher, through an incision in the anterior wall of the stomach, was first performed by von Mikulicz[11-13] in 1903, and the procedure was later modified by Rotgans,[14] who performed dilatation by forcefully invaginating the anterior wall of the stomach through the cardia. Since this operation accomplishes little more than dilatation by the natural oral route and is not without danger, it deserves little consideration here.

Extramucous cardiomyotomy, based on the view that true spasm of the cardiac sphincter existed, was proposed by Gottstein[15] in 1901, but was not actually performed until 12 years later by Heller.[16] Of the 104 cases in which this procedure was done, previously collected by us,[10] results were good in 76.9 per cent and improved in 5.7 per cent, with 13.4 per cent recurrences and 3.8 per cent deaths.

Cardioplasty is another plastic procedure which is analagous to pyloroplasty. It consists of incising longitudinally through the entire wall of the cardia, as suggested by Marwedel[17] in 1903 and performed seven years later by Wendel,[18] or incising longitudinally only down to the mucosa, as modified by Girard[19] in 1915, and then suturing the resultant defect transversely. Of 36 cases collected from the literature[10] in which cardioplasty was performed, good results were reported in 93.1 per cent, recurrences in 2.8 per cent, and the mortality was 2.8 per cent.

Excision of the cardia, followed by esophagogastrostomy, originally proposed by Rumpel[20] in 1897, scarcely seems justified. In our opinion the most rational procedure is esophagogastrostomy, which may be performed as a side-to-side anastomosis between the esophagus and stomach, thus short-circuiting the cardiac orifice, or preferably in a manner similar to the Finney gastroduodenostomy. The objection to side-to-side anastomosis is the presence of a spur, which may obstruct passage of food from the esophagus into the stomach. We prefer the gastroesophagostomy, as originally advocated by Heyrovsky[21] in 1912, in which the cardiac spur is destroyed and a much wider opening is created between the stomach and esophagus, thus permitting better emptying. Of 97 cases of esophagogastrostomy collected by us and two of our own,[10] there were five deaths, one poor result and excellent results in all the rest. Further experience with this procedure since that time by a number of observers, as well as by us, has supported this conviction.[22,23] Incidentally, it has been frequently noted that the functional results following this operation, as well as some of the other procedures, are much better than the roentgenologic studies would indicate.

Although esophagogastrostomy may be done through a transthoracic approch, the transabdominal approach is preferable in our opinion. Either a high left paramedian incision or a left subcostal incision paralleling the costal margin is made. The cardia may be readily exposed by division of the left lateral hepatic ligament to permit retraction of the left lobe of the liver. The peritoneum is incised over the esophagus at the site of its reflection on the diaphragm and the esophagus is freed circumferentially by sharp and blunt dissection. A sling of umbilical tape is placed around the esophagus to permit traction downward as it is mobilized from the hiatus by blunt dissection with the index finger. The esophagus is gradually pulled down into the peritoneal cavity from a distance of about 10 cm. A strip of umbilical tape is tied tightly around the uppermost portion of the mobilized esophagus. After the first posterior row of interrupted quilting cotton sutures is placed, an incision is made paralleling this

row of sutures, through the stomach and esophagus and carried through the cardia. The second posterior row of sutures is applied as a continuous through-and-through stitch, No. 00 chromic catgut on an atraumatic needle being used, and is then brought anteriorly as a Connell stitch. This is followed by a final row of interrupted Lembert cotton sutures. A few interrupted cotton sutures are used to tack the diaphragm to the esophagus and to the fundus of the stomach in order to avoid traction on the suture line. The strip of umbilical tape tied around the esophagus is cut and removed.

Operations directed toward the diaphragm are based on the opinion that the condition is the result of overactivity, failure of relaxation or incoordination of the diaphragmatic crura. Bassler,[24] in 1914, suggested division of the diaphragmatic crura, but Vampré[25] concluded that it was irrational, as he consistently obtained poor results. In 1913, von Hacker[26] suggested drawing the esophagus down and "straightening it out," in addition to enlarging the diaphragmatic hiatus, but good results have not been obtained with this procedure.

Surgical procedures directed toward the nerve supply of the esophagus are based on the theory that achalasia is a disease of the autonomic nervous system; both the vagus and the sympathetics have been incriminated. In 1911, Meyer[27] performed vagotomy in addition to esophagoplication, but he was unable to obtain good results and that has been the experience of others.[28-30] There was only one satisfactory result in 11 collected cases in which vagotomy was performed.[10]

Récalde[31] was probably the first to attack the sympathetics. In 1924, he reported good results in three out of four cases in which decortication of Auerbach's plexus was performed. These clinical observations were confirmed experimentally 10 years later by Knight,[32,33] who demonstrated the presence of a true sphincter mechanism at the cardia; he further showed that bilateral vagal section reproduces the clinical and pathologic picture of achalasia and that sympathectomy relieves the condition. Based on his observation that in the human the sympathetic supply to the cardiac sphincter is derived chiefly

from the left side of the celiac plexus and distributed along the left gastric artery, he advocated sympathectomy by excision of this artery and the surrounding fat and nervous tissue. Of five patients treated in this way, he reported complete relief in one, considerable improvement in one and recurrence in three. Results by this method reported by others since then have not been impressive. Craig, Moersch and Vinson[34] obtained a good immediate result in a patient with achalasia treated by bilateral resection of the cervicothoracic sympathetic ganglia and trunk. Although they noted immediate improvement in a patient operated on by a similar technique, complete recurrence followed several weeks later.

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THE MEANING OF LYMPHOID TISSUE.*

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The function of the lymphoid tissue in Waldeyer rings is still not fully explained in spite of very extensive and painstaking investigations. One reason for it may be the fact that the lymphatic system of the oropharynx is a big organic complex, whose physiological function depends not only on the faucial and pharyngeal tonsils alone but also on the whole lymphatic plexus. The question whether or not the lymphoid tissue of Waldeyer's ring is identical with the other lymphatic system in its function and histological, anatomical structure is still not fully decided.

Lymphoid tissue consists essentially of a mass of free cells, the vast majority of which are lymphocytes of various sizes, together with a supporting framework, consisting of reticulum cells and of fibrous, elastic and sometimes muscular elements. Aschoff's classification of lymphoid tissue still stands:

1. Lymphatic tissue in the lymph nodes. This type of lymphatic tissue has afferent and efferent lymphatic vessels and is situated in the lymph stream.

2. Lymphatic tissue in mucous membranes; it has only efferent lymph vessels and is situated in the fluid streams going from the mucous membrane into the interior of the organism.

3. Lymphatic tissue in the spleen. This type of lymphatic tissue has neither afferent nor efferent lymph vessels and is situated in the blood stream.

According to most investigators the Waldeyer ring belongs to the second group; lymphoid tissue which has efferent lymph vessels only, embedded in mucous membrane and exposed to

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the outside; it is very similar to the lymph system of the intestinal tract, which also has only efferent vessels. According to Stoehr,[1] the function of the Waldeyer lymph follicles and intestinal lymph follicles is the same.

Lymphoid tissue as a defense mechanism:

It has long been held, mainly as a result of clinical observation, that the lymphoid tissues play an important part in the body's defense reactions. We owe to Virchow[2] (1860) the first precise formulation of the theory that the lymph nodes act as barriers. This author points out that in a lymph node "the elements lie crowded together like the particles in a charcoal filter, so that the lymph trickles out again on the other side in a more or less purified state."

Since Virchow's day, the barrier theory has remained virtually unchanged, so that McMaster and Hudack[3] could write, in 1935: "Pathogenic bacteria carried in the lymph stream are often arrested in the glands through which this stream passes, with the result that the infection travels no further."

The barrier theory for lymph nodes was generally accepted and soon the concept of a defense mechanism spread to other lymphoid tissues, although the justification was not so obvious. The tonsils and nasopharyngeal lymphoid tissue are considered as the guardian of the alimentary canal.

Reaction Centers: "Hellman (1921) and Hellman and White[4] (1930) believed that the lymphoid tissues protected the body against harmful substances circulating in the blood stream. This function is discharged by the reticuloendothelial cells and also by the germ centers, which Hellman called "reaction centers," and believed to be regions where noxious agents have prevented the lymph from reaching the blood, but once they have entered the blood, the reaction centers quickly remove them. In other words, the reticuloendothelial elements in the lymph sinuses act as filters to the lymph; the reaction centers, presumably, as filters to the blood."

Drinker and Jaffey[6] state: "There is one aspect of the barrier problem which is usually completely disregarded. In

attempting to assess the defensive value of the lymphoid apparatus, one must consider not only the nodes and other lymphoid masses, but also the lymphatic vessels which are connected with them. If we adopt this wider viewpoint, it becomes apparent that we are often dealing with a mechanism of doubtful utility; for, even if one were to accept without reservation the view that the lymph nodes help to prevent the spread of infection or of malignant growths, it is obvious that the lymphatic vessels facilitate this spread. Any barrier reaction of the lymph nodes is more than offset by the dangerously rapid extension of disease that lymphatic vessels render possible. One has only to contemplate, for example, the case of a small epithelioma on the back of the hand, with axillary metastases.

"Apart from the lymph nodes, the most notable collections of lymphoid tissue to which a protective function has been assigned are those associated with the alimentary canal — *i.e.*, the nasopharyngeal lymphoid tissue, the appendix, Peyer's patches and the solitary lymphoid nodules. The evidence that these collections of the lymphoid tissue are not protective consists mainly in the fact that chronic infections frequently reside in the tonsils and in the intestinal tract; that acute infections, such as typhoid fever, have a special predilection for the lymphoid tissue of the bowel; and that, after such common operations as tonsillectomy, the general health of the individual is apt to improve, and the incidence of throat infections to grow less." Statistical evidence on these issues — such as that presented by Kaiser[5] (1922, 1932), by Hardy (1938) and by Glover and Wilson (1932) on the results of tonsillectomy — does not, however, offer convincing argument.

Function of lymphoid tissue in health:

Drinker and Jaffey[6] state: "Difficult as it may be to understand the rôle of lymphoid tissue in disease, the problem becomes even more complexing when we consider the function of lymphoid tissue in health. The total amount of lymphoid tissue in the body is probably in the neighborhood of 1 per cent of the body weight. What is the function of this 'silent' lymphoid organ in persons who are suffering neither

from infections nor from neoplastic disease? Are we to assume that this lymphatic tissue is present throughout life, merely on the chance that at some time or other it may have a defensive rôle of doubtful utility, or can we assign to it an alternative function? Several such functions have been suggested, but the one best established is the continuous formation of lymphocytes."

So far as we now know, the continuous production of lymphocytes is the main function of lymphoid tissue.

Lymphoid tissue during malnutrition and starvation: There is a very extensive literature on changes in the lymphoid tissues during malnutrition and starvation. This has been carefully reviewed by Jackson[7] (1925) for the lymph nodes, thymus and alimentary canal. The lymphoid tissues appear to be more sensitive than the rest of the body to shortage of food, the thymus being outstanding in this respect and having been designated on that account "a barometer of nutrition."

The number of lymphocytes in the blood is the result of a balance between incoming and outgoing cells, and may, therefore, be varied through changes in the number of either or of both. Lymphocytosis may thus follow: *a.* entry of lymphocytes into the blood in increased numbers, while the number leaving remains unchanged (active lymphocytosis) or *b.* entry of lymphocytes into the blood in normal numbers, but exit in numbers less than normal, so that there is a retention of lymphocytes in the blood (passive lymphocytosis).

Ehrlich and Lazarus[8] (1905) also believed that the lymphocytosis, in general, was of simple mechanical origin. "Accordingly, one is obliged to conclude that a lymphocytosis occurs when, in response to an increased circulation of lymph in a greater or less extensive lymphatic region, more elements are mechanically forced from the lymph glands. . . . We must, therefore, consider lymphocytosis as the result of a mechanical process." This flushing out of lymphoid tissues is probably responsible for lymphocytosis of rapid onset.

There are, however, several types of more slowly developing lymphocytosis, associated with hypertrophy of the lymphoid

tissues, in which the rate of lymphocyte production is apparently stepped up more gradually, but remains at a higher level for some time.

From this review of the literature it is evident that great strides have been made to clarify our conception in regard to the histology, morphology and function of lymphatic tissue. We in the field of otolaryngology are so frequently confronted with the evidence of marked hyperplasia of lymphoid tissue in the form of enlarged tonsils and adenoids in children; in those cases where the history speaks of repeated infections in the upper respiratory tract, one assumes hyperplasia of lymphoid tissue is a defense reaction against the invading organism; but we have more difficulty to find any plausible explanation for such hyperplasia in children, where to all knowledge no serious infection has taken place. Is this only a localized condition of Waldeyer's ring due to some irritation of the reaction center, for which there is no clinical evidence? Or is it a part of a generalized increased activity of the whole lymphatic system, significant for this age group? If so, there should be other clinical evidence, such as enlarged lymph nodes in other parts of the body, maybe in some cases even an enlarged spleen. As it has been stated before, the main function of the lymphatic system is production of lymphocytes; therefore, it is of interest to find out whether or not generalized hyperplasia of such a large plexus of lymphoid tissue as the Waldeyer's ring will manifest itself in the blood picture by an increase of lymphocytes above the normal. One hundred children in the age group from two to eight were examined. In a great percentage of these cases hyperplasia of the nasopharyngeal lymph tissue was found. The history obtained from the parents showed no serious infection of any significance of these organs; the examination included the size of the tonsils and adenoids, anterior and posterior cervical nodes and palpation of spleen; a differential blood examination completed this survey.

The absolute and relative number of lymphocytes varies within wide limits at different age periods throughout the early years of life. Following the neutrophilic leucocytosis

that is present at birth, the neutrophiles decrease and the lymphocytes increase, so that after the tenth day the lymphocytes constitute over 50 per cent of the white cells. They remain at this level throughout most of the first two years of life; then, after the second year, they decrease gradually until at six the figure normal for the adult is reached, between 30 and 40 per cent.

In an acute or chronic infectious disease, a relative increase in lymphocytes may be considered as evidence of convalescence or satisfactory healing of the underlying morbid process. In hyperplasia of the lymphoid tissue and in iron deficiency anemia there is frequently a relative increase in lymphocytes.

SIZE OF TONSILS IN RELATION TO AGE.

Age	2	3	4	5	6	7	8	—
Normal tonsils	5	9	7	5	1	3	—	30
Large tonsils	4	4	2	20	9	6	6	51
Very large tonsils	2	5	5	7	—	—	—	19

NUMBER OF LYMPHOCYTES IN RELATION TO SIZE OF TONSILS.

	20%	30%	40%	50%	60%	70%
Normal tonsils	—	8	8	12	2	—
Large tonsils	—	15	21	9	6	—
Very large tonsils	—	3	5	5	6	—

From this statistical tabulation it is evident that hyperplasia of Waldeyer's ring in children who do not give a history of any serious throat infection is more prevalent in the age group five to eight; normal sized tonsils were mostly found in younger children. I believe most otolaryngologists and pediatricians will report similar findings; the usual explanation given for this phenomena is the already mentioned barrier theory; in the first three years of life the tonsils are not so frequently exposed to infection as later on; every infection stimulates the reaction center, which is followed by progressive changes of the whole lymphoid tissue. Some authors, as Dietrich, Berggren[9] consider destruction of bacteria as the normal function of Waldeyer's ring; such a process always causes a certain inflammatory reaction. According to Hoepke,[10] after birth tonsillar tissue should never be thought

of as normal; all lymphoid tissue is constantly exposed to irritations; therefore, hyperplasia of Waldeyer's ring will be found in most children in the age group four to seven, whether or not there is any history of infection.

In the second table the number of lymphocytes in the blood in relation to the size of the tonsils was recorded; in no case was an abnormal number of lymphocytes found; normal and large tonsils in the different age groups showed equal variation in the number of lymphocytes, all within normal limits, that is, between 30 per cent and 60 per cent of the white blood cells. From this investigation one must assume that hyperplasia of the nasopharyngeal lymph tissue does not influence the number of lymphocytes circulating in the blood stream. These findings further substantiate the now prevailing opinion that the function of the lymphoid tissue of Waldeyer's ring is not identical with the function of other reticuloendothelial organs — although there is a certain similarity from an anatomical and histological point of view; as already stated, the tonsillar lymphoid tissue has only efferent lymph vessels; therefore, it does not fully participate in lymphatic circulation; the lymph capillaries do not penetrate into the germinal centers but end blindly at the epithelium; the peripheral sinus is absent.

Where, then, do the lymphocytes go? We should keep in mind lymphoid tissue in the digestive tract is covered by epithelium of the mucous membrane; there exists a very intimate functional relation between these structures. Histological examinations have revealed that a migration of lymphocytes through the epithelium takes place; this is accomplished partly by their own motility, partly by passive action, such as deglutition and swallowing of food. Oeller[11] states that many more lymphocytes pass through the epithelium into the digestive tract than find their way into the blood stream. The contents of the crypts, which so often by mistake are called pus, are mostly pure lymphocytes. Eigler[12] after extensive experiments came to the conclusion that those lymphocytes play an active part in the process of fermentation of food.

SUMMARY.

Differential blood examinations were conducted in children who showed clinical evidence of hyperplasia of Waldeyer's ring but gave no history of any serious infections of those structures. The purpose was to find out whether the number of lymphocytes circulating in the blood is influenced by such hyperplasia. It was clearly demonstrated that even very marked, long standing hyperplasia does not alter the absolute or relative number of lymphocytes. This again brings out the fact that lymphoid tissue in the digestive tract embedded in the mucous membrane is functionally different from the lymphoid tissue in the lymph nodes. Most of the lymphocytes produced in this structure find their way through the epithelium into the digestive tract. Most authors feel the barrier theory is untenable, but believe further investigation of the microchemical process of the lymph cells might bring light as to the function of the lymphoid tissue of Waldeyer's ring.

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THE ROLE OF THE RHINOLOGIST IN RHINOPLASTY.*

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It must be apparent to most rhinologists that in recent years there has been a marked awakening of interest in plastic surgery of the organs we treat. This renewed interest has been manifested by the older men as well as by the vast majority of young men coming into the specialty. This has brought about a number of serious problems which merit the earnest attention of all concerned. Rhinologists have suddenly realized that an important phase of their specialty was almost completely ignored for a number of years. Textbooks on ear, nose and throat prior to 10 years ago contained practically nothing on the subject. Comparing our attitude in this matter with that of the ophthalmologists, we must confess our neglect and backwardness. Plastic surgery of the orbit and the lids has long been practiced, taught and developed by ophthalmic surgeons and has merited the respect of surgeons at large, regardless of their specialty. In rhinology, on the contrary, the few who sought to enlist interest in this important branch of the specialty were like prophets howling in the wilderness. The index of the *Proceedings of the American Laryngological Association*, covering the first 50 years of that organization, lists a bare seven articles on plastic surgery of the nose. It is indeed strange that the pioneer work of Dr. J. O. Roe, some 40 and 50 years ago, should receive so little mention today, despite the fact that it is still recognized in foreign countries. Later, in 1914, when Loeb's book on Operative Surgery of the Nose, Throat and Ear appeared, with an extensive chapter on Plastic Surgery by Dr. Joseph Beck, it occasioned only passing interest and was soon forgotten.

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Until very recently there were very few institutions where the elements of rhinoplasty were taught. As a matter of fact, there were many rhinologists who knew very little about such an elementary subject as the treatment of nasal fractures. This is indeed a sad commentary and is rendered even more dismal when we realize that recognition of the importance of the subject has, with few exceptions, not come from the top but rather through growing pressures from the lower ranks in the specialty. All of our readers, however, have not been asleep and voices have recently been raised in support of this outlook. Coates,[1] in an address before the American Academy, said, "The rhinologist, through his training in and familiarity with nasal physiology and instrumentation, definitely fits into the picture and with proper training is able to do excellent work in the field." J. Mackenzie Brown,[2] just a year ago, made the following statement: "The rhinologist of tomorrow will find himself in a position in which he must practice reconstructive surgery of the nasal pyramid as well as of the internal nose and sinuses in order to restore normal nasal function to his patients."

Without indulging further in self-recrimination, let us consider for a moment the reasons for this recent avid interest in rhinoplasty and discuss the problems arising therefrom. It had its inception after World War I and received added impetus in World War II through the medium of antibiotics, which saved the lives of many wounded men, who in previous wars were lost through infections, and who provided the large material for reconstructive plastic surgery. Since this affected every surgical specialty, it was only natural that nasal and facial injuries should have enlisted the interest of rhinologists. Another factor has been the increasing awareness of the American public of the importance of esthetics, probably stimulated by the movies and photo magazines and heightened by race consciousness. Finally, it is general recognized that the practice of otolaryngology has been undergoing a marked transition in recent years and is still in the process of a newer evolution.

This was recognized as long ago as 1921 by Dr. Mosher,

who in his Presidential Address before the American Laryngological Association made the following comment, which is even more apropos today: "But do straight laryngology and straight rhinology give the abundant opportuntiy that the young men of today want? I do not think they do. It is only by frankly accepting as part of the specialty the subjects in medicine and surgery that border on laryngology that it can retain its vitality, that it can offer a full medical life and attract and win the better class of recruits."

As evidence of the changing aspect of our specialty, let me mention the following: tonsillectomies used to be strictly a specialist's operation; however, for a number of years we have been instructing our internes in the technique and, as a result, it is probable that most of these operations are being performed by other than nose and throat specialists. Otitis media used to be entirely within the province of our specialty, but since the advent of the electric otoscope most cases are being diagnosed and treated by pediatricians and general medical men. Endoscopy was developed by laryngologists and has long since grown into a recognized specialty in its own right; furthermore, specialists in diseases of the chest and chest surgeons are learning to pass the bronchoscope and are doing a large share of their own bronchoscopies. To top it all off, our recently acquired knowledge of nasal physiology has restricted the indications for sinus surgery and antibiotics have reduced to a minimum mastoid and other complications.

Is it any wonder, then, that our younger men are seeking newer knowledge whereby their opportunties for expansion in the specialty may be increased? What could be more natural than to seek ways and means of establishing rhinoplasty as a recognized branch of rhinology? Is it any more illogical to consider the correction of nasal deformities within the scope of rhinology than plastic surgery of the lids and orbit in ophthalmology or orthoplasty in orthopedics?

One of the most important aspects of rhinoplasty which should concern the rhinologist pertains to deformity which is the result of trauma. When a patient sustains an injury to the nose, what is more natural than for him to seek the advice

of a nose specialist? What can be more important, therefore, than adequate knowledge of diagnostic and therapeutic procedures necessary for the restoration of both function and contour? Furthermore, when an individual is suffering from the effects of nasal obstruction and in addition has become conscious of a deformity resulting from a previous injury, what could be more logical than to seek advice from a rhinologist? In many instances the submucous resection even when skillfully performed fails to relieve the patient because of the deviation of the pyramid, obliquity of the nares or constriction due to deformities of alar or upper lateral cartilages. Unless the problem is considered as a whole, a satisfactory result will not follow. Recognition of the intimate relation between the external and internal nose, insofar as function is concerned, should be paramount. The two cannot always be disassociated; therefore, the importance of a full knowledge of all the accepted procedures which may need to be employed in the restoration.

Assuming that the young rhinologist has had a training in general surgery as well as his own specialty and understands the problems of tissue response to trauma, the mechanics of healing, the fundamentals of surgical procedure and the physiology of the organs within his specialty, what is necessary to qualify him to do this type of surgery?

In the first place, it must be recognized that mere ambition and fundamental knowledge do not presuppose the adaptability which is necessary to develop a good plastic surgeon. The difference between the average and the outstanding surgeon becomes more apparent when the surgery involves the structures of the face. A poorly performed abdominal operation is mercifully or painfully buried within that cavity, but a badly executed nasal operation is constantly exposed to the critical inspection of all who would look, frequently to the utter chagrin of the surgeon and the everlasting dismay of the patient.

Rhinoplasty requires not only surgical skill and judgment but also a deep understanding of human nature, patience, kindness and, above all, a conservative and respectful attitude toward the problems involved and the results that may be

expected. All the frills and fancies which many men employ to impress their patients are not only unnecessary but also serve to accentuate the false impression in the minds of many patients with regard to the glamourized and often over-publicized aspect of the specialty. Remodeling a structure made up of live bone, cartilage, skin and mucous membrane is an entirely different proposition from constructing a similar organ out of plaster, cement or modeling compound.

In the second place, the rhinoplastic surgeon must always bear in mind that the maintenance of normal nasal function is paramount in every rhinoplastic procedure and must take precedence. Consequently, normal tissues should be preserved as far as possible, since it is a well known fact that implanted tissues are never equal to those which normally belong in that particular region.

In the third place, it must be recognized that the procedures described and elaborated by Jacques Joseph are still the foundation of all our present day operations and that such innovations and improvements as have been generally adopted are the result of painstaking study on the part of experienced surgeons who have been through the mill. Progress is often the result of trial and error, and we have no quarrel with those enthusiasts who are constantly seeking to elaborate a foolproof technique. What we do object to is the tendency of established hard and fast rules in matters which have as yet failed to stand the test of time.

Finally, it should be understood that the development of a proficiency in rhinoplasty is not a simple fly-by-night adventure but a long and painstaking process requiring study, concentration and practice. It would seem reasonable to expect that the rhinologist who deals with problems affecting the nose and sinuses every day of his life, and is accustomed to working in these cavities, would at least stand in the fore as the most logical person to take care of deformities which not only affect the external contour of the nose but the vital functioning structures within.

Since it is my conviction that rhinoplasty is intimately bound-up in rhinology, I believe it is our duty to instruct our young men in the elements of its practice. This is possible only in institutions having large clinical material on which to draw and having an experienced teaching staff. Under guidance and supervision over a period of one or two years, it should be possible to determine whether the neophyte possesses the necessary understanding and skill to qualify him for this sort of work. Having a knowledge of the interior of the nose and all its adnexa, and a full appreciation of the anatomic variations and physiological aberrations, such an individual should be in the best position to judge how much surgery is necessary and how safely it could be performed.

This attitude in no way minimizes or detracts from the excellent contributions which general surgeons and plastic surgeons have made to the practice of rhinoplasty and for which we are all deeply grateful. The fact that they have given freely of their knowledge and experience, as exemplified in many sessions of the American Academy, is evidence of their good will and desire to spread the knowledge where it will do the most good.

It is up to us to see that those who earnestly seek instruction in this fascinating branch of surgery and are properly qualified be given the opportunity to acquire the necessary knowledge and skill. It is equally our duty to circumscribe the field within the limits of our specialty and to discourage irresponsible and widespread surgery by the inexperienced and unqualified practitioner. Our specialty suffered too long the odiom of reckless surgery of the sinuses and can ill afford to have the same thing happen in another branch of the practice.

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MAGNETIC INFLUENCE IN BRONCHOSCOPY.*

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The mysterious qualities of the magnet have intrigued the minds of men since the dawn of history. Magnets were first used for medical purposes by charlatans. Early in the nineteenth century, a New England quack by the name of Perkins achieved wealth and notoriety with his magnetic tractors, and even today in the cheap magazines one can read advertisements extolling the benefits for whatever ails you from a "magnetic belt" or from magnets in the shoes!

Powerful electric magnets for some years have been used in extracting metallic fragments from the eye, and shortly after World War I, Jackson, Tucker and Clerf used such a magnet in dislodging a bullet in the upper lobe of a veteran's lung and drawing it down into a main stem bronchus for removal by forceps.

The first practical permanent magnet for everyday use in bronchoscopy was introduced in 1944. This was a small cylinder of aluminum, nickel and cobalt manufactured by the General Electric Co. This alloy requires no batteries, and its strong magnetic qualities persist indefinitely. It may be attached to a ureteral catheter for intrabronchial work. For use in the stomach, it may be fixed to a flexible wire, which is shielded by a Levin tube through which the stomach may be inflated, or the magnet may be tied to a string. The size and shape of the magnet may be varied: a straight cylinder, 3 mm. in diameter and 45 mm. in length, for bronchoscopic work, to a curved cylinder, 5 mm. in diameter by 40 mm. in length, for use in the stomach and duodenum.

Many metallic objects have been removed through a bronchoscope from the tracheobronchial tree by means of forceps. This, of course, remains a standard procedure; however, when

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a straight pin, for example, drops down into a very small bronchiole, it is too deep for the smallest bronchoscope to reach, and one must probe with the forceps, guided by a biplane fluoroscope. Even when the pin is reached, it is difficult to open the forceps enough to grasp the pin. A foreign body usually continues down the tracheobronchial tree until it becomes more or less impacted. Once the object is held tightly in a bronchiole, it is difficult to get the forceps around it without causing considerable trauma. In contrast, if you can get the magnet within a few millimeters of the metallic object, it is usually strong enough to extract it from its site and to withdraw it with little or no harm to the tissues. As the magnet and bronchoscope are removed, not infrequently the vocal cords will strip the foreign body from the magnet; but when this happens the object lies high in the trachea, and no difficulty is experienced in completing the extraction.

Open safety pins are still swallowed all too often. Obviously the pin goes down spring first. Obviously, too, an attempt to pull the pin back without first closing it, a most difficult feat, can succeed only if the point is first brought into the scope. Wood, of Nashville, was able in many cases to grasp the pin with forceps and push it down into the stomach, there to reverse it and to bring it back up the esophagus, the point trailing. In this way no appreciable damage is done the esophageal mucosa. With the magnet, this maneuver is much more easily accomplished.

Once a metallic foreign body has entered the stomach the question arises, will it clear the gastrointestinal tract without harm? Often, of course, it will pass harmless *per viae naturales*. On the other hand, it may become caught in the gut, particularly the upper duodenum, or find its way outside the gastrointestinal tract to cause serious trouble elsewhere in the body. In addition to the case of an Atlanta physician whose death was attributed to a straight pin in the region of the appendix, I mention the case of a little girl who suffered several months from severe pyelitis, but recovered uneventfully when a bobby pin, found embedded in the right kidney, was removed surgically.

From time to time, foreign bodies have been removed from the stomach by means of flexible forceps, but this is a singularly difficult undertaking. When the stomach is inflated, as it must be to grasp the foreign body with forceps, even with the aid of a biplane fluoroscope, it is almost as hard to pick up with forceps as to find a needle in a haystack. Providing only the object is magnetizable, a curved magnet fixed to a wire makes it a relatively simple procedure: once the tip of the magnet comes in contact with the wall of the stomach, if the fluoroscope shows the foreign body is in the cardia, but the magnet pointing towards the pylorus, a flip of the wire causes it to proceed up into the cardia to attract the foreign body; or if it is in the distal portion of the stomach, a turn the other way will guide the magnet into the antrum.

Once a piece of metal has passed the pylorus, it is necessary to estimate the probabilities. Because the patient is usually under six and, therefore, there is a marked disproportion between the size of his abdominal cavity and the hand of the surgeon which must explore the retroperitoneal duodenum, the risk of operation is high. If the foreign body has no sharp points or cutting edges, and it is not too big, the chances are that it will continue through the gastrointestinal canal uneventfully. If, however, the foreign body has not gotten past the ligament of Trietz at the end of four or five days, the chances that it will are slight.

Last Spring I succeeded in removing with the magnet a nail that had been in the second portion of the duodenum of a little boy five days. I reported this before the American Medical Association in Atlantic City. A few weeks later a child of two and a half, in whose duodenum a bobby pin had remained some two weeks, was brought to the Ponce de Leon Infirmary. The magnetic removal of this was reported before the Southern Medical Association in November.

Here is the third case:

Two-year-old Johnny was brought to the infirmary at 9 p.m. on Jan. 13, 1948, with a history of having swallowed a tack some four hours earlier.

The Roentgenogram taken on admission (see Fig. 1) revealed the shadow of the tacks, five-eighths inch long, point down, overlying the vertebral column and the air bubble outlining the stomach. The "mine detector" buzzed violently when the Berman locator was placed over the stomach, so it was thought that the removal of the tack from the stomach could be easily accomplished. The child was anesthetized with ether and a curved magnet fixed to a wire was introduced into the stomach and,

Fig. 1.

under fluoroscopic guidance, the magnet was repeatedly passed over the tack without budging it. It was then apparent that the tack had already passed into the duodenum, so this magnet was withdrawn and another, tied to a heavy waxed thread, inserted. A second plate (see Fig. 2) showed that the magnet had fallen back into the fundus (these X-rays were taken with the child lying on his back), but the tack was still in its original position.

The child was returned to bed. His arms were put in cardboard splints to keep him from pulling on the string tied to the magnet, and he was carefully watched. About seven o'clock the next morning his mother observed that this string was suddenly drawn down. This phenomenon was evidently the result of the magnet being propelled through the

Fig. 2.

pylorus. At 10:30 a.m., X-ray revealed that the magnet had established contact with the tack in the traverse portion of the duodenum (see Fig. 3). A lateral view with the child lying on his left side (see Fig. 4) showed the magnet and tack in the descending limb of the duodenum. Under fluoroscopic guidance, with gentle traction of the string, magnet and tack were withdrawn in a few seconds. The next day he went home, well.

COMMENT.

Reconsideration of the original plate corroborated the fact that the tack was in the duodenum, for if it had been lying free in the stomach it, too, would have fallen toward the back, that is, to the upper fundus, as the magnet had done. It may

Fig. 3.

also be remarked that the point of the tack pointing distally, and the fact that the tack remained in the same place until the magnet caught up with it, indicate that the point of the tack was beginning to perforate the wall of the duodenum.

DISCUSSION.

In the past 12 months five children have been brought in with metallic foreign bodies in the duodenum: a nail, a bobby pin, a tack, another bobby pin and an open safety pin. The first three named were removed through the natural channels

Fig. 4.

with the magnet, and the patients went home the next day none the worse for their misadventure. These are the only instances that I know of in which a foreign body in the duodenum has been removed from above. In the other two cases

the pin had become firmly fixed in the wall of the duodenum and during the manipulation of the magnet the patient went into shock. It, therefore, seemed advisable to admit defeat and turn these two children over to a general surgeon for open operation. After a most tempestuous convalescence, both of them finally recovered completely.

The day has not yet come when every practitioner can carry a magnet around in his handbag. Though the magnet itself is such a simple piece of apparatus, its proper use requires many technical aids, as well as a trained team and an experienced operator. In this day of synthetics and substitutes, too often safety pins, bobby pins and even straight pins are made without enough steel to respond to magnetism. I have written to the leading manufacturers of such articles to request them once again to use enough steel. At present, however, it is well to employ a modification of the mine detector so useful in the recent war to determine if the foreign body is magnetizable before introducing the magnet. Such an instrument is the Berman locator, made by the Waugh Laboratories, a subsidiary of the General Electric Co. That a good X-ray machine is required goes without saying. I have found that a plastic table is helpful. The proximal end is shaped so that the head may more easily be manipulated, and the transparence of the plastic does not interfere with the use of the fluoroscope, nor with recording the progress of the operation for a permanent record. Of course, laryngoscopes, bronchoscopes and esophagoscopes of various sizes also are necessary, as well as a variety of magnets such as I have described. Not least important is a good team of assistants: as a minimum the surgeon requires an anesthetist, an intern and an X-ray technician.

SUMMARY.

Providing only that the foreign body aspirated or swallowed is susceptible to magnetism, the magnet provides the simplest and safest means of retrieving it. Such objects are withdrawn from the tracheobronchial tree by means of a slender magnet with greater ease and less trauma to the tissues than by means of forceps. Leading an open safety pin in the esophagus down

into the stomach, reversing it and pulling it back up with the point trailing is one of the most important uses of the magnet. When a metallic object is in the stomach, the magnet makes its removal easy. Further experience has convinced me that in cases of doubt it is wisest to remove such foreign bodies before they pass the pylorus. Once it has entered the duodenum, if it appears that it will not pass through the natural channels, that is, if its operative removal is necessary, the surgeon has his choice of open exploration with high morbidity and much danger, or of removing it with a magnet in the expectation of sending the child home well the next day.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

The Home Study Courses sponsored by the American Academy of Ophthalmology and Otolaryngology, in the basic sciences related to these two specialties, will be given again, beginning Sept. 1, 1948. Registrations must be completed before Aug. 15. Detailed information may be secured from Dr. William L. Benedict, Executive Secretary, 100 First Avenue Building, Rochester, Minn.

IN MEMORIAM

OTTO MARBURG, M.D.

Dr. Otto Marburg, of New York, internationally prominent neurologist, died June 13, 1948, at Mount Sinai Hospital, at the age of 74. He was born in Roemerstadt, Austria, and had achieved an enviable reputation in Europe before coming to America in 1938 to escape the Nazis.

Graduating from the University of Vienna in 1899, he continued his work in the laboratory of Dr. Hans Obersteiner. He studied in Berlin, under Dr. Herman Oppenheim; in Paris, under Pierre Marie, and later was with Wagner-Jauregg, noted discoverer of the malarial treatment for paresis.

In 1905, Dr. Marburg was made assistant to Dr. Obersteiner, became associate professor in 1912, and in 1919 succeeded his mentor as director of the Neurological Institute, where he won recognition as dean of teachers in this field.

Many of Dr. Marburg's books have become standard works, but probably those best known in this country are the "Mikroskopischtopographisch Atlas des Menschlichen Zentralnervensystem," which ran to three editions, and the formidable four-volume "Handbuch des Neurologie des Ohres," written in collaboration with Gustav Alexander.

His studies in epilepsy and amaurotic family idiocy, as well as brain tumors and malformations of the brain, brought him fame in this field and he was recognized as an authority on these subjects.

On arriving in America, Dr. Marburgh encountered many difficulties before securing a license to practice without the formality of examination; however, through the intervention of friends and associates, he was granted a license *honore causi.*

He became clinical professor of neurology at the College of Physicians and Surgeons of Columbia University and had his own laboratory there. He was consultant to Montefiore and Post-Graduate Hospitals.

Dr. Marburg was vice-president of the International Neurological Congress and was an honorary member of the American Neurological Association, the Philadelphia and New York Neurologic Societies and various other kindred associations.

We quote from the credo which he left with his former student and later associate, Dr. E. David Friedman: "I am full of gratitude to this great nation, which wants nothing for itself but helps as much as possible those who need help. This I experienced personally when I was expelled from my home and place of activity. This magnanimity is characteristic of America, as is the old pioneer spirit which helps overcome all obstacles. Thus my last words may very well be, 'God Bless America'."

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION.

Aurex (Semi-Portable); Aurex Model C-B, Model C-A, Model F and Model H.

Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago, Ill.

Beltone Mono-Pac; Beltone Harmony Mono-Pac.

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Manufacturer: Dynamic Hearing Aids, 43 Exchange Pl., New York 5, N. Y.

Electroear Model C.

Manufacturer: American Earphone Co., Inc., 10 East 43rd St., New York 17, N. Y.

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Manufacturer: Maico Co., Inc., North Third St., Minneapolis, Minn.

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Manufacturer: Otarion Hearing Aids, 448 N. Wells St., Chicago, Ill.

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Ravox (Semi-Portable).

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Manufacturer: Micronic Corp., 101 Tremont St., Boston 8, Mass.

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Manufacturer: Nichols & Clark, Hathorne, Mass.

Vactuphone Model 3.

Manufacturer: Allen-Howe Electronics Corp., 150 Main St., Peabody, Mass.

Western Electric Orthotronic Model 125; Western Electric Model 63; Western Electric Model 64; Western Electric Models 65 and 66.

Manufacturer: Western Electric Co., Inc., 120 Broadway, New York 5, N. Y.

Zenith Radionic Model A-2-A; Zenith Radionic Model A-3-A; Zenith Radionic Model B-3-A; Zenith Model 75.

Manufacturer: Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

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